

Figure A.8-2. (Continued).

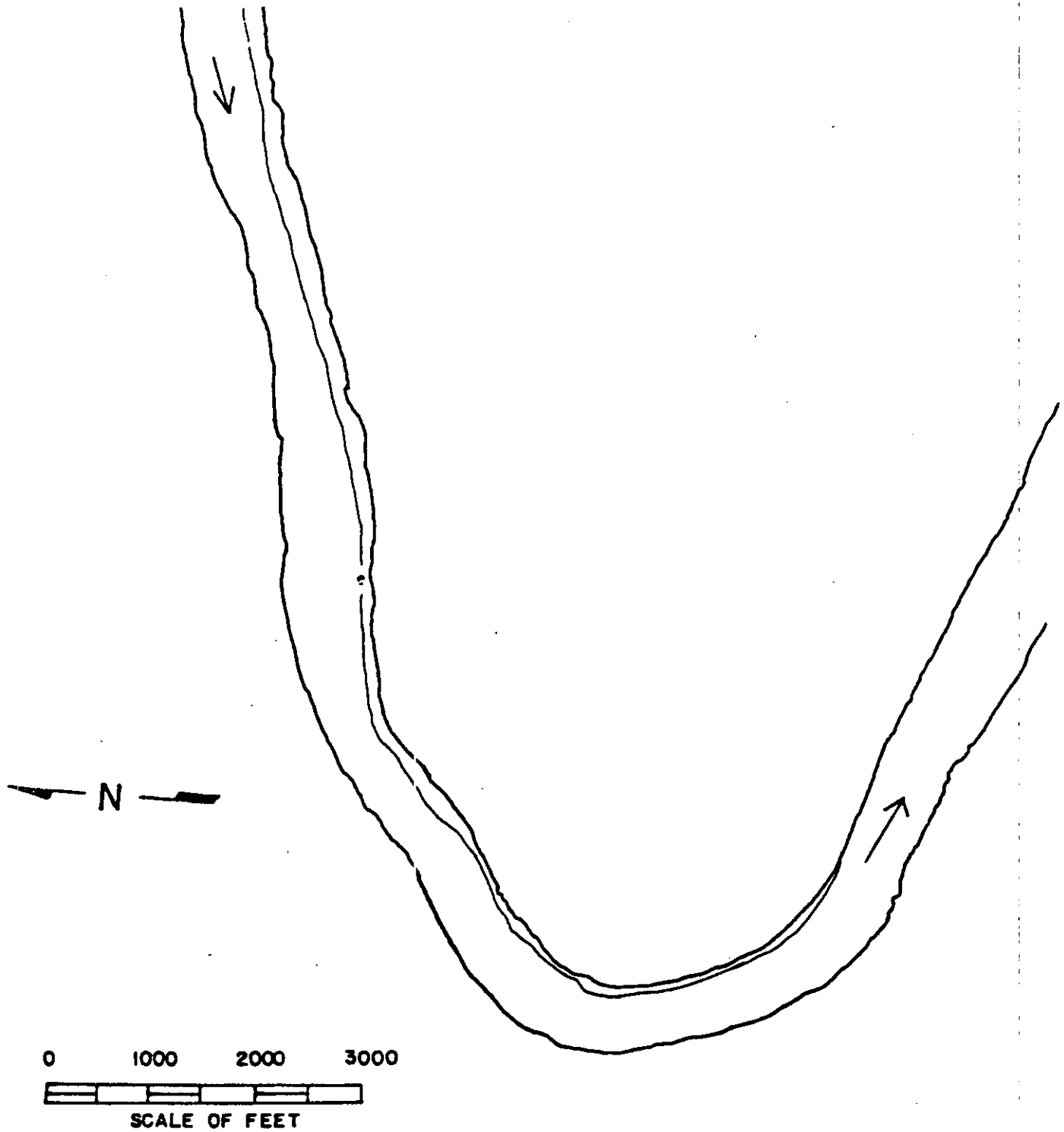


Figure A.8-2, (Continued).

A.9. REANALYSIS OF HISTORICAL TEMPERATURE AND FLOW

(EC)

A.9-1. Objective

To determine if a relationship exists between ambient water temperature and Potomac River flow.

A.9-2. Data Source

Ref. 1.

A.9-3. Study History

EIA analyses of water temperature and river discharge taken at the USGS station at Hancock, Md. from 1971-1977 (Appendix A.7) suggested a weak correlation in summer and no correlation in other seasons. Because the reported flow-temperature relationship did not correlate as expected with other literature sources, the data were reanalyzed to see whether the results could be corroborated.

A.9-4. Sampling Method

Continuous automatic monitors were used at the USGS station at Hancock, Maryland.

A.9-5. Analysis

- Correlation analyses between river temperature and flow were done for the entire 1971-1977 period and monthly within this period.
- Simple linear regressions were done using river temperature and flow both monthly and for the entire period.

A.9-6. Results

- The general relationship between mean monthly water temperature and stream flow is shown in Figure A.9-1.
- Correlations between concurrently measured discharge and water temperature for the period 1971-1977 and monthly intervals are shown in Table A.9-1 and Figures A.9-2 through A.9-14.

- Regression and correlation analyses show that water temperature and stream flow are significantly and inversely related for the entire period (1971-1977) but that this relationship is inconsistent from month to month (Table A.9-1, Figures A.9-2 through A.9-14).
- Water temperature and stream flow were positively correlated in winter months ($P < 0.01$) (i.e., December-February) and negatively correlated in spring and summer months ($P < 0.01$) (April-September) (Table A.9-1).
- The highest correlations between stream flow and temperature were seen in July (-0.662) and February (0.562).

A.9-7.

Significance and Critique of Findings

- Water temperature and stream flow in the Potomac River are inversely correlated ($p < 0.01$) over all months for the period 1971-1977.
- Water temperature and stream flow in the Potomac River correlated ($P < 0.01$) in all months taken individually except March, October, and November.
- Water temperature and stream flow near R.P. Smith display the accepted literature relationship of positive correlations in winter and negative correlations in the remainder of the year.

Table A.9-1. Correlations of water temperature and stream flow at the USGS Hancock station in the upper Potomac River from 1971-1977.

Month	Number of Data Pairs	Correlation	P-level
All months	2,418	-0.321	P < 0.01
January	182	0.268	P < 0.01
February	181	0.562	P < 0.01
March	248	0.126	P < 0.10
April	220	-0.332	P < 0.01
May	217	-0.275	P < 0.01
June	210	-0.382	P < 0.01
July	218	-0.662	P < 0.01
August	217	-0.484	P < 0.01
September	209	-0.422	P < 0.01
October	186	-0.092	P < 0.25
November	175	-0.121	P < 0.10
December	155	-0.373	P < 0.01
All mean months	12	-0.824	P < 0.01

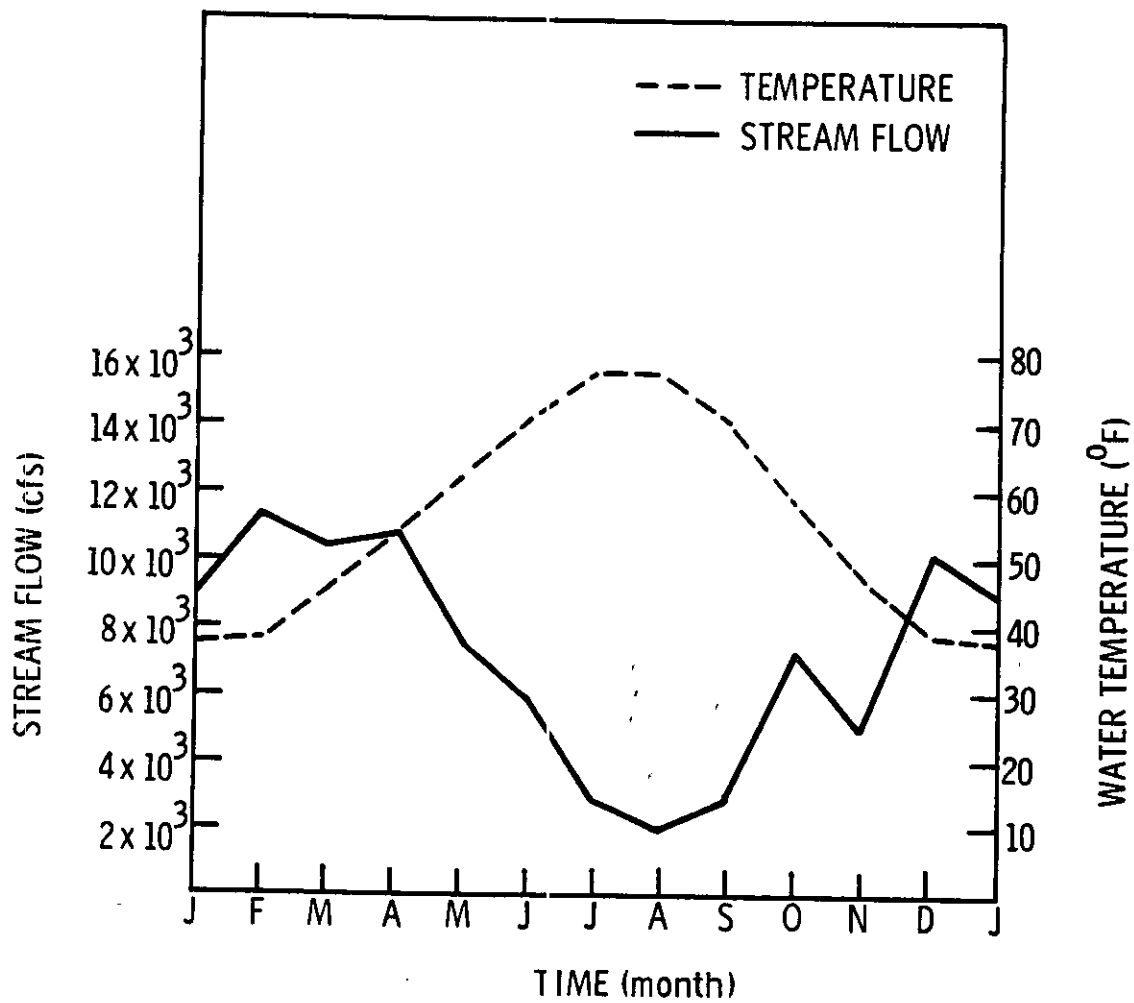


Figure A.9-1. Mean monthly stream flow and water temperature at USGS Hancock Station from 1971-1977.

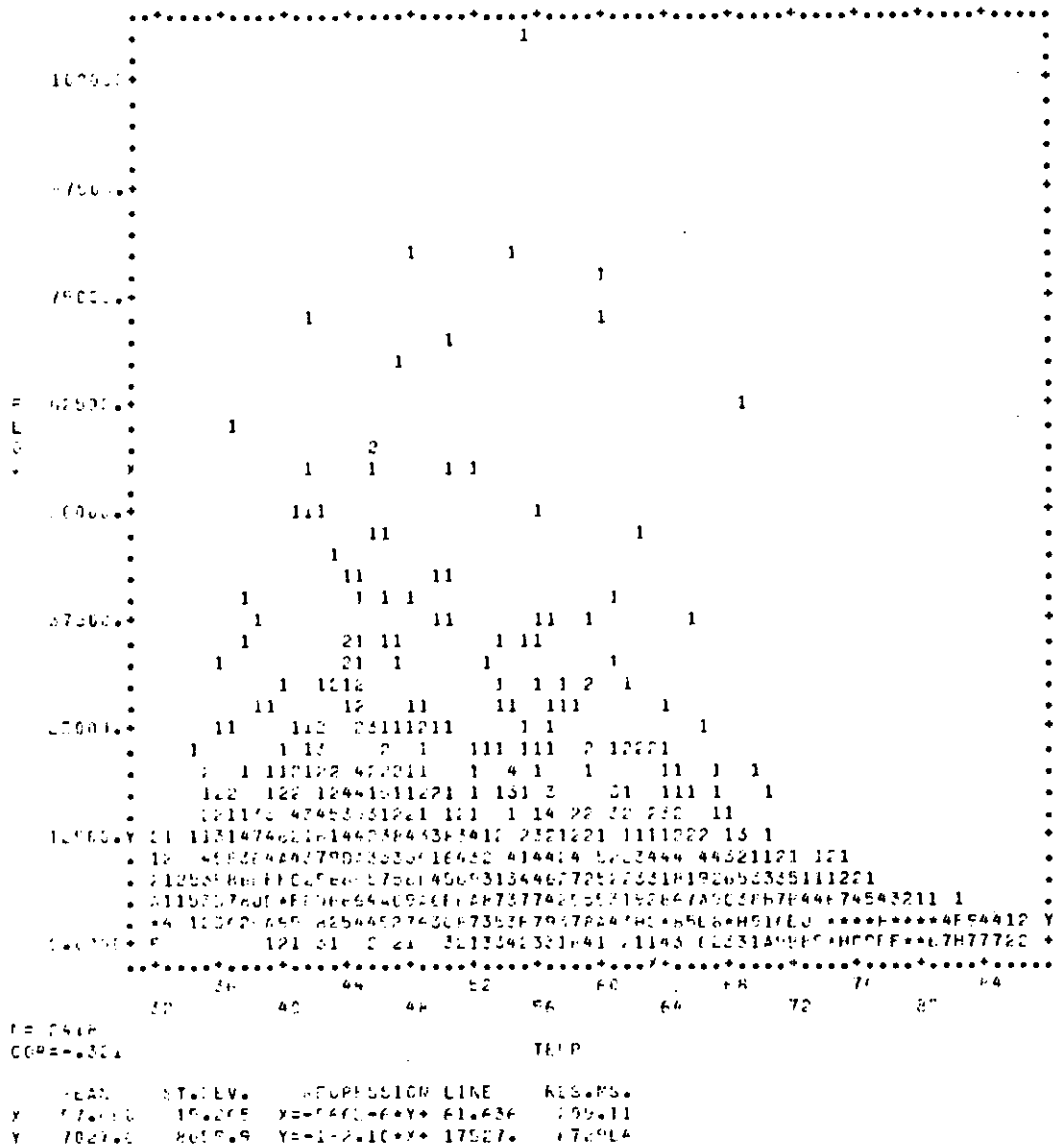


Figure A.9-2. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) at USGS Hancock station, 1971-1977.

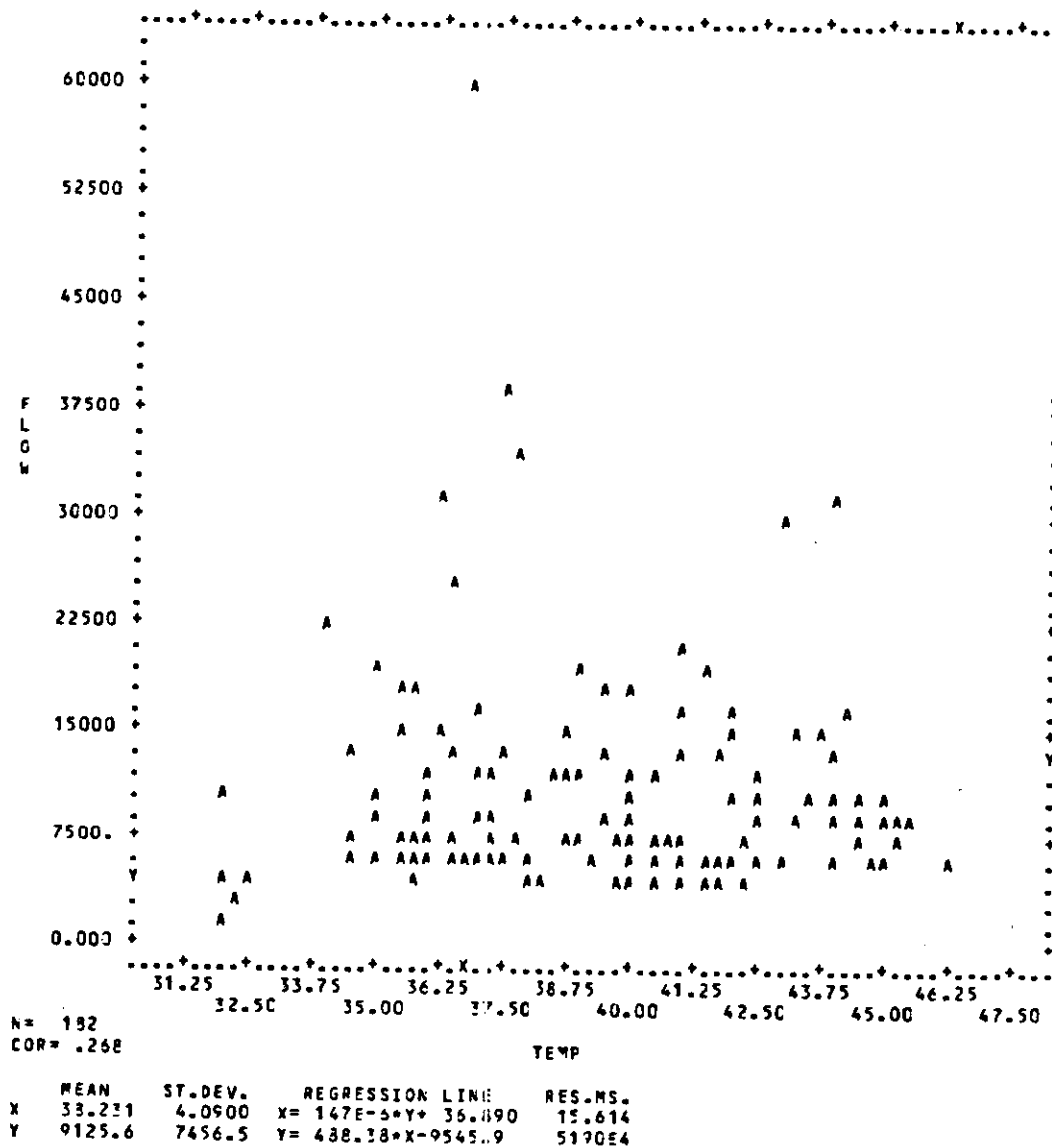


Figure A.9-3. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in January (1971-1977).

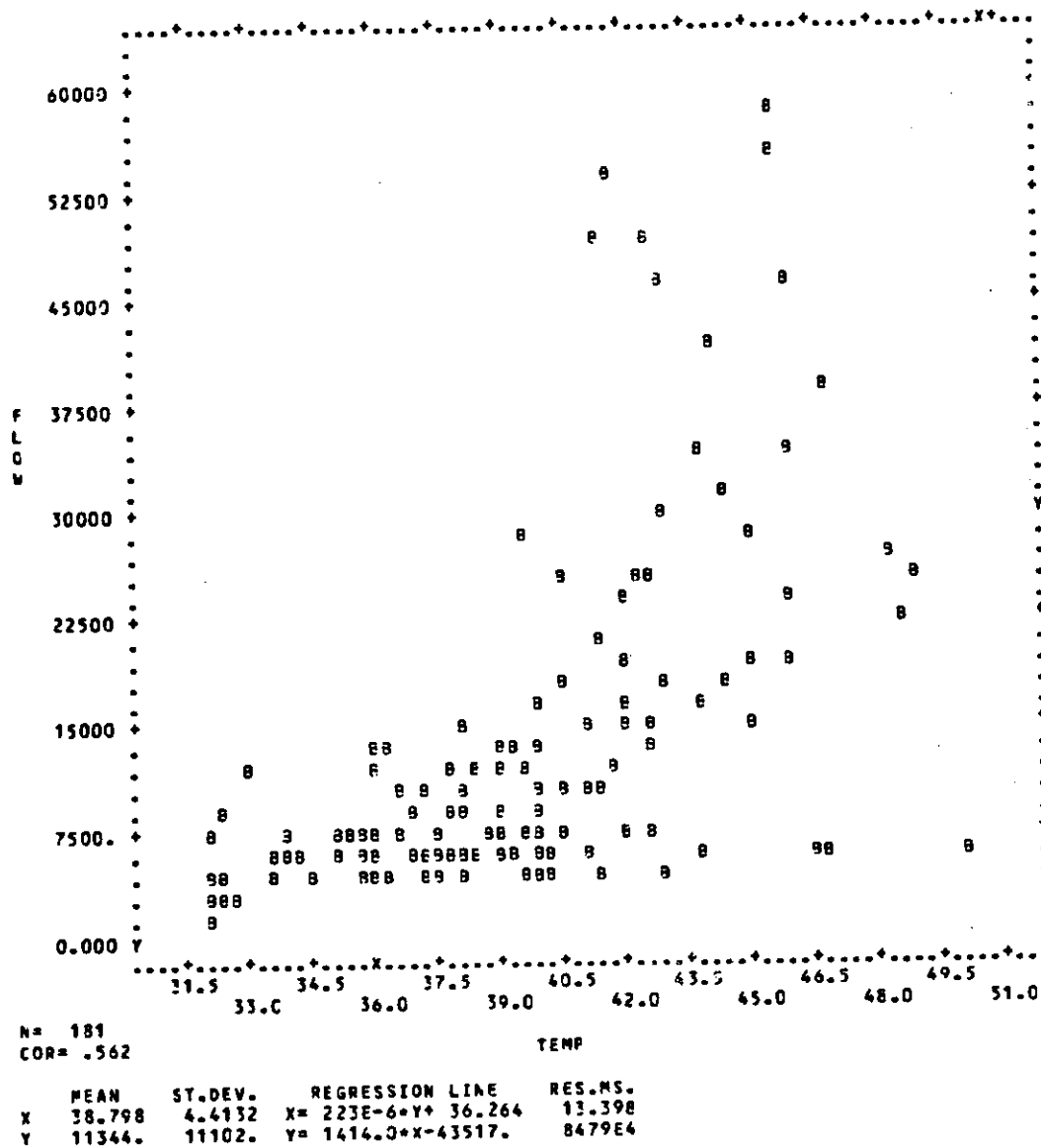


Figure A.9-4. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in February (1971-1977).

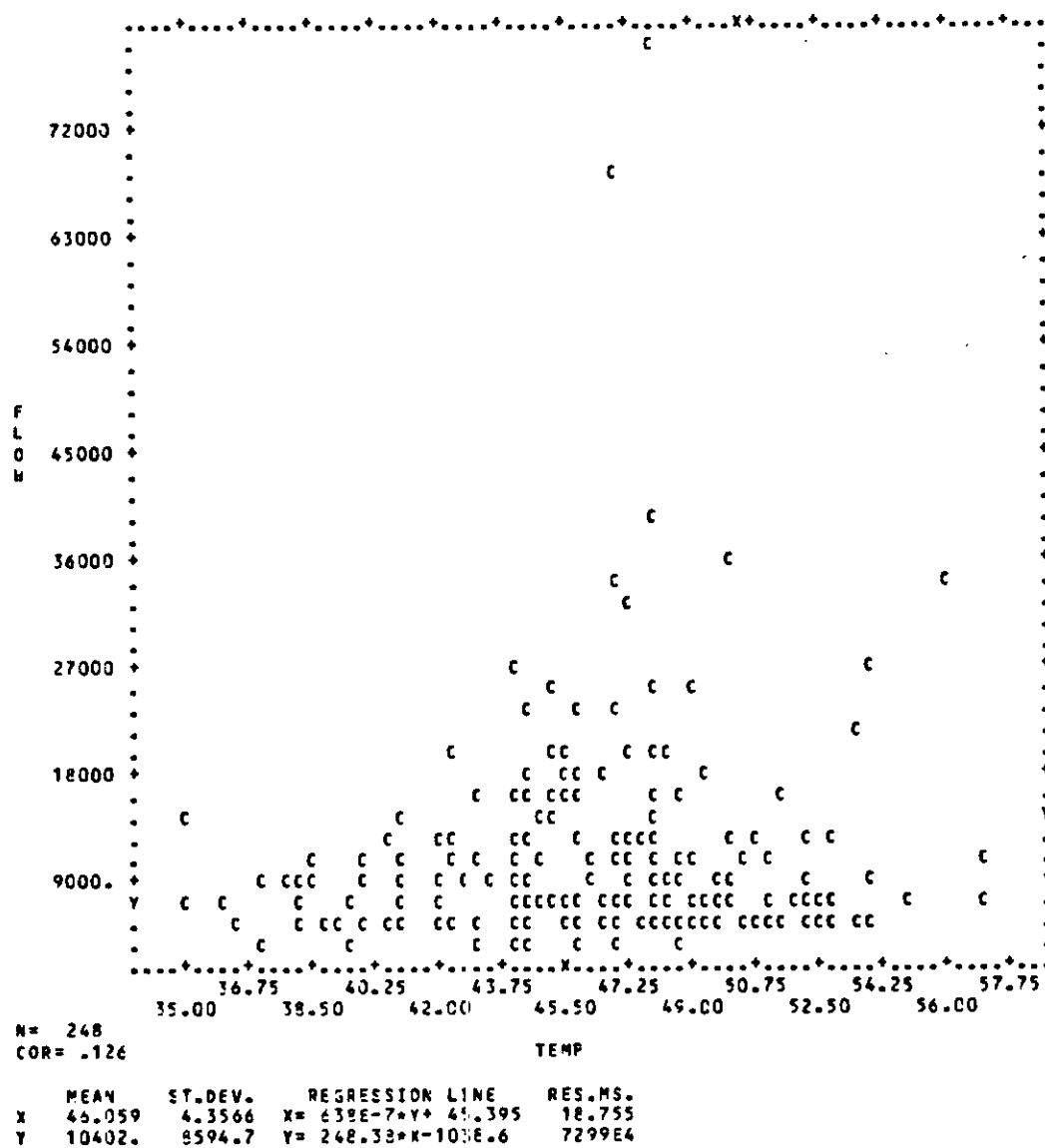


Figure A.9-5. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in March (1971-1977).

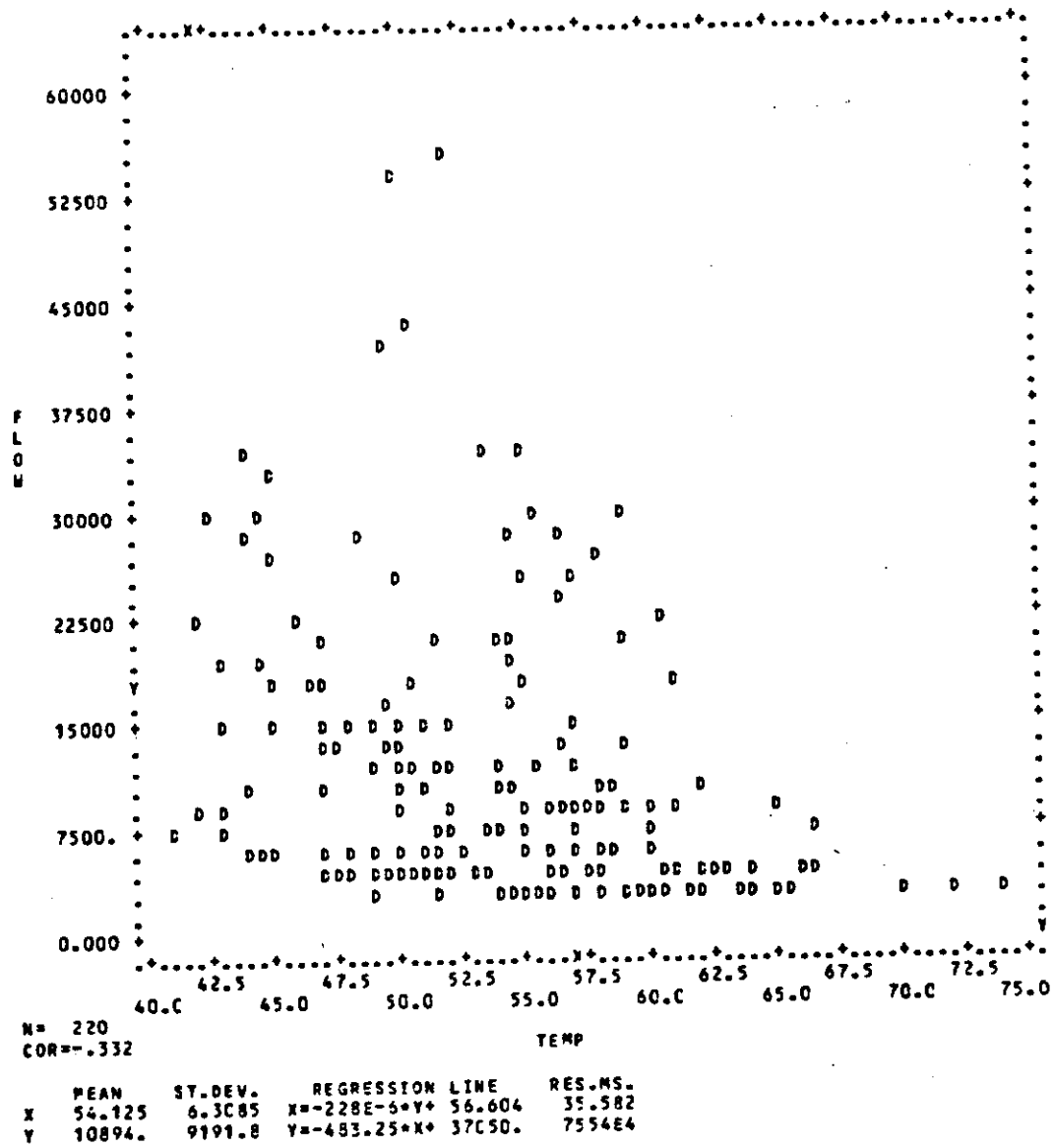


Figure A.9-6. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in April (197101977).

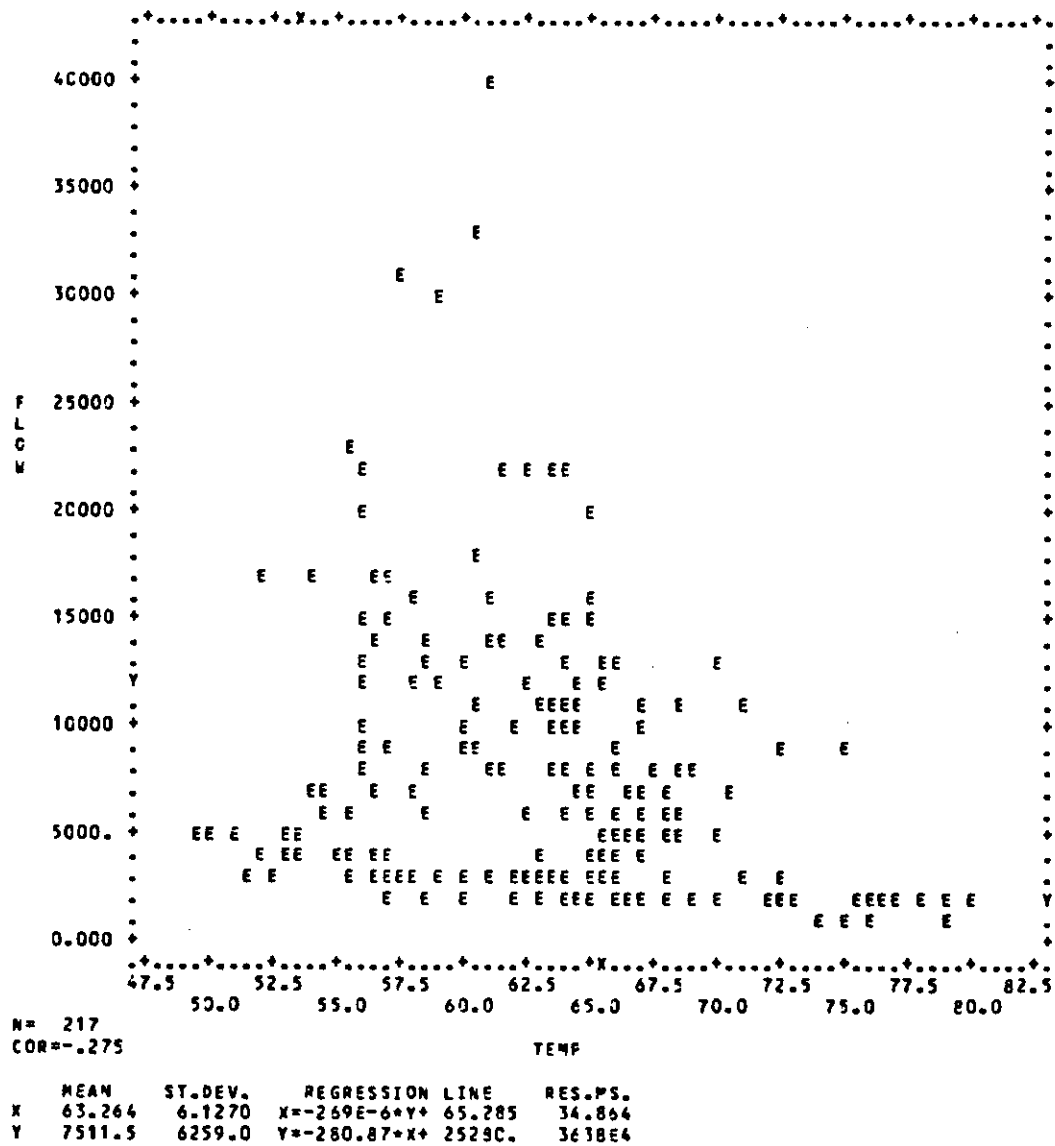


Figure A.9-7. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in May (1971-1977).

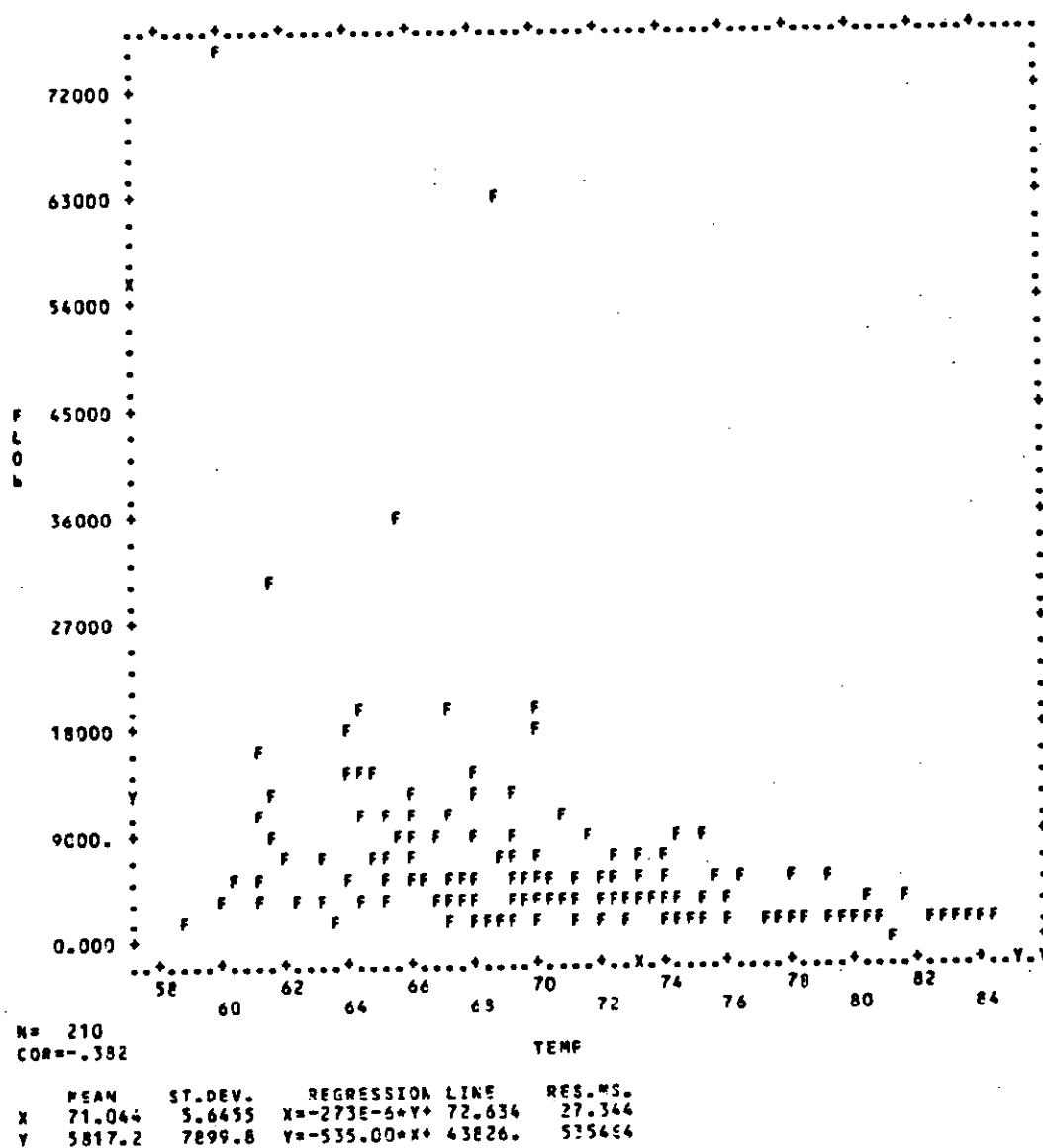


Figure A.9-8. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in June (1971-1977).

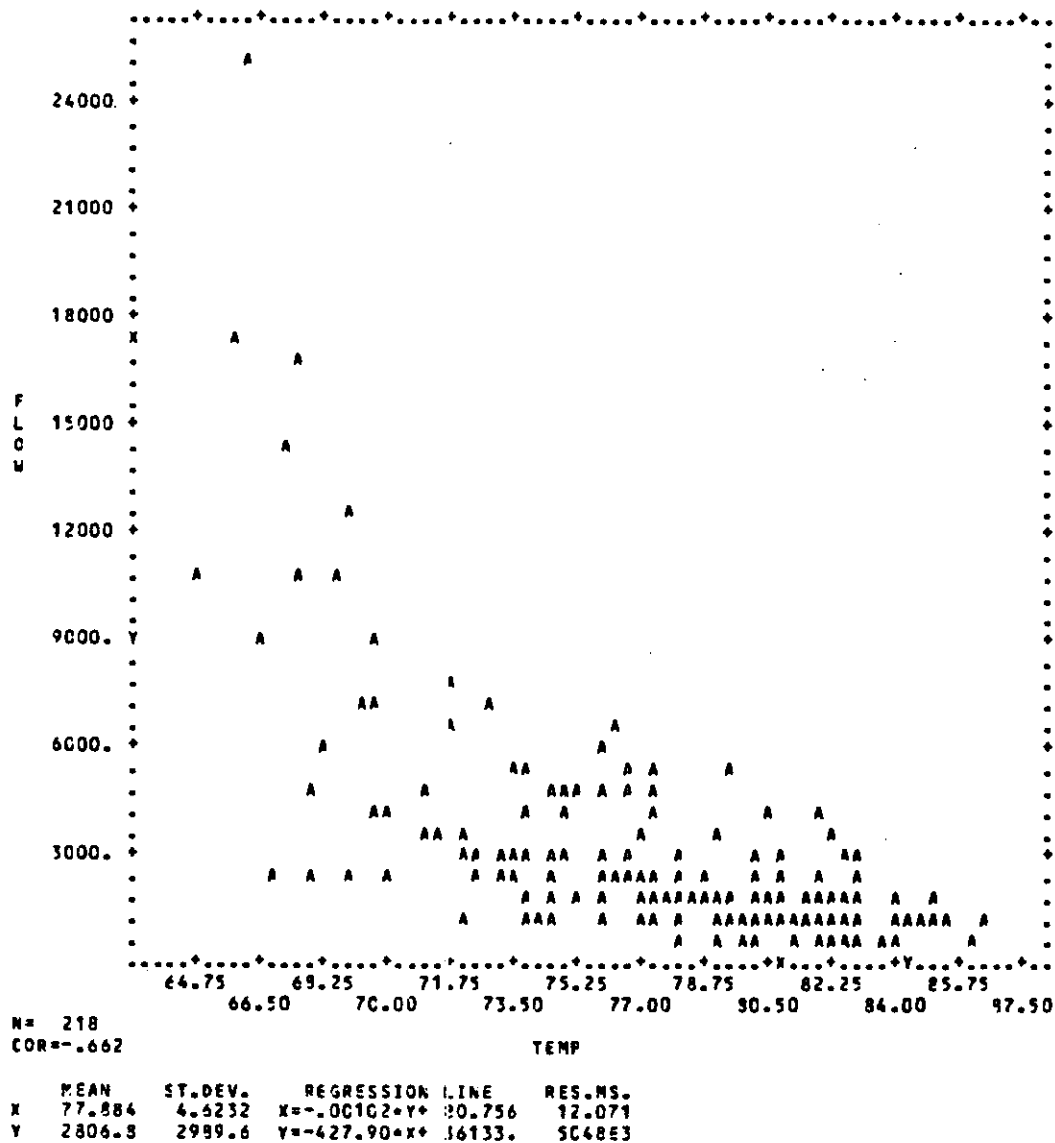


Figure A.9-9. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in July (1971-1977).

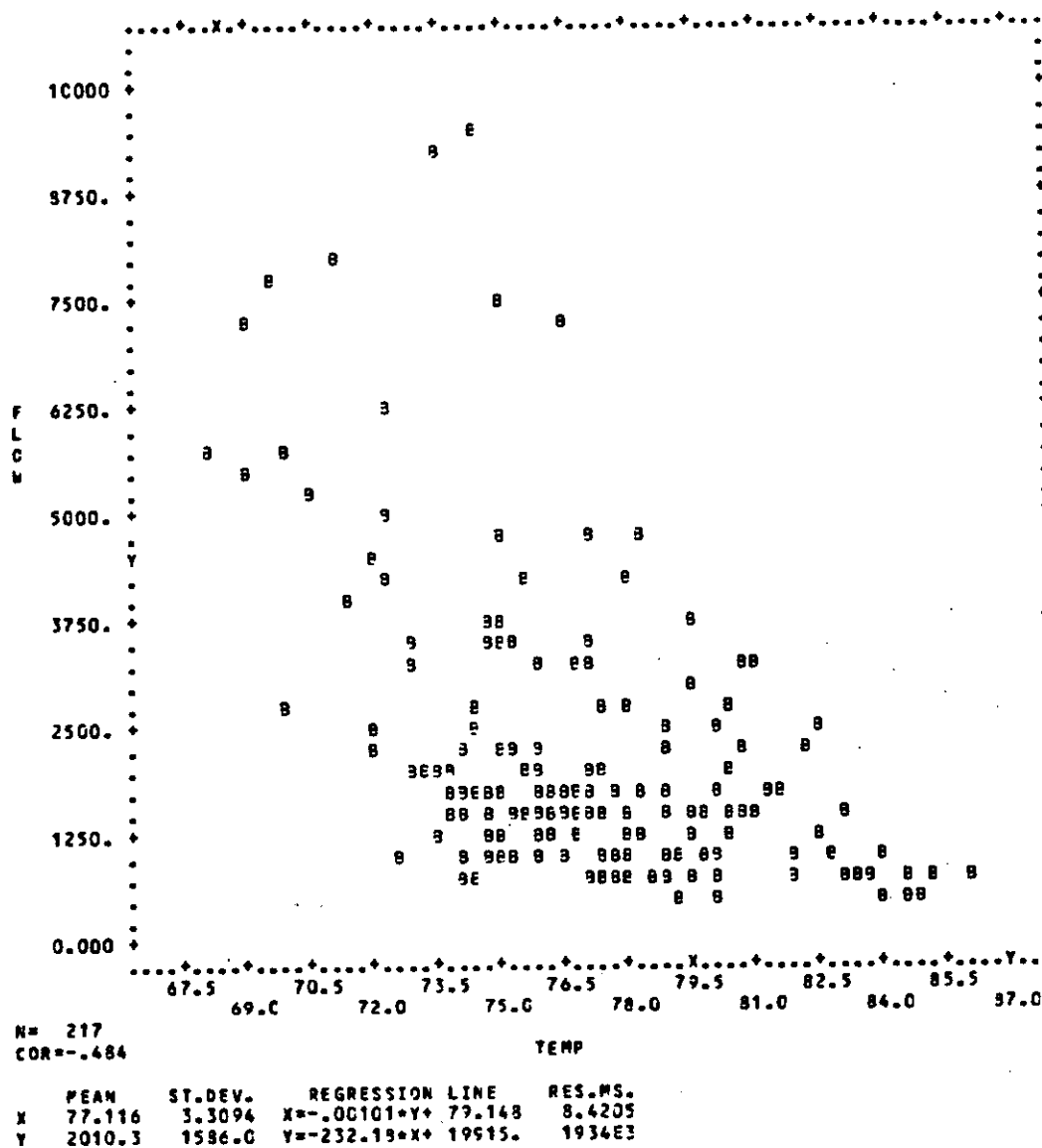


Figure A.9-10. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in August (1971-1977).

Martin Marietta Environmental Center

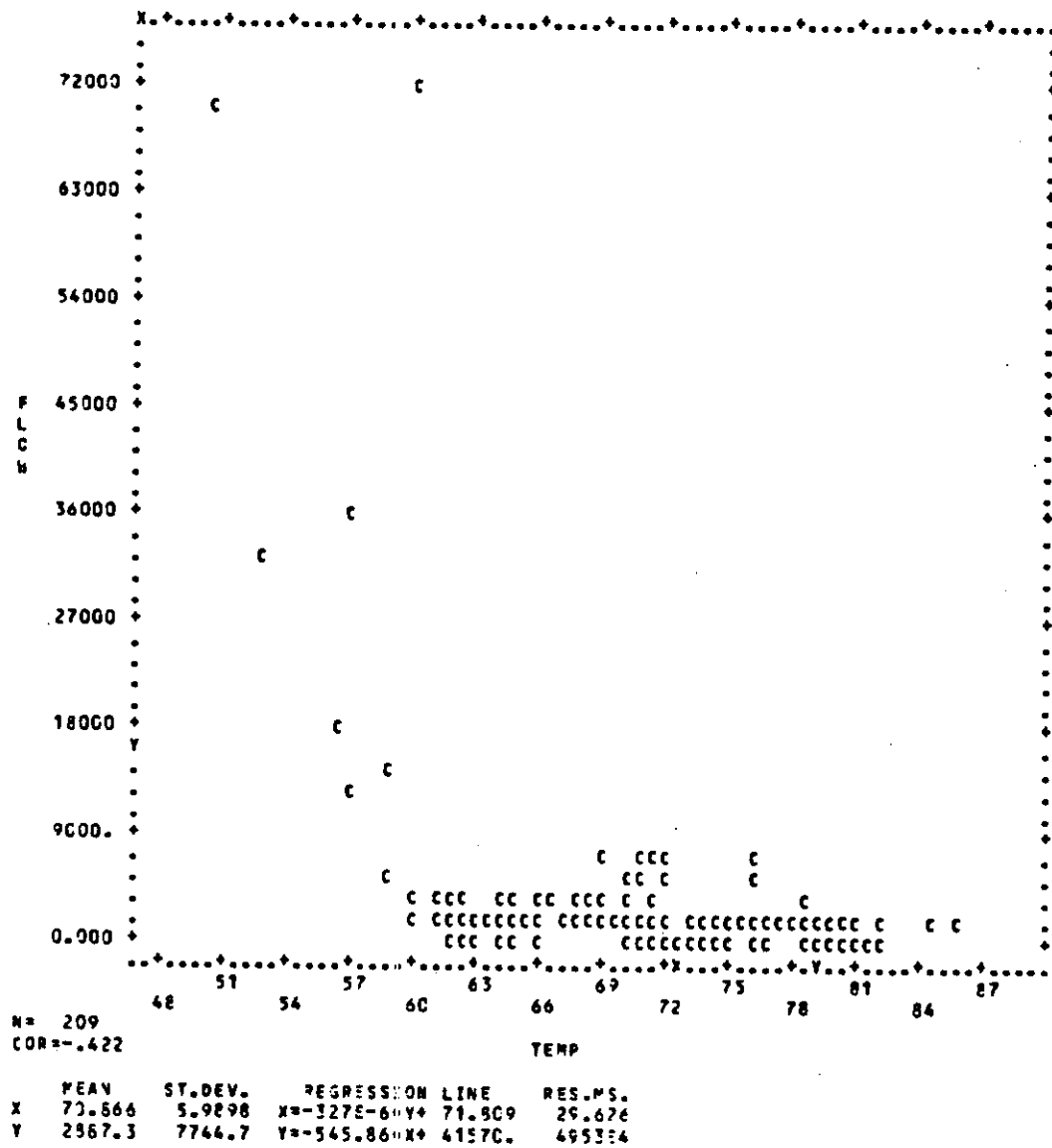


Figure A.9-11. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in September (1971-1977).

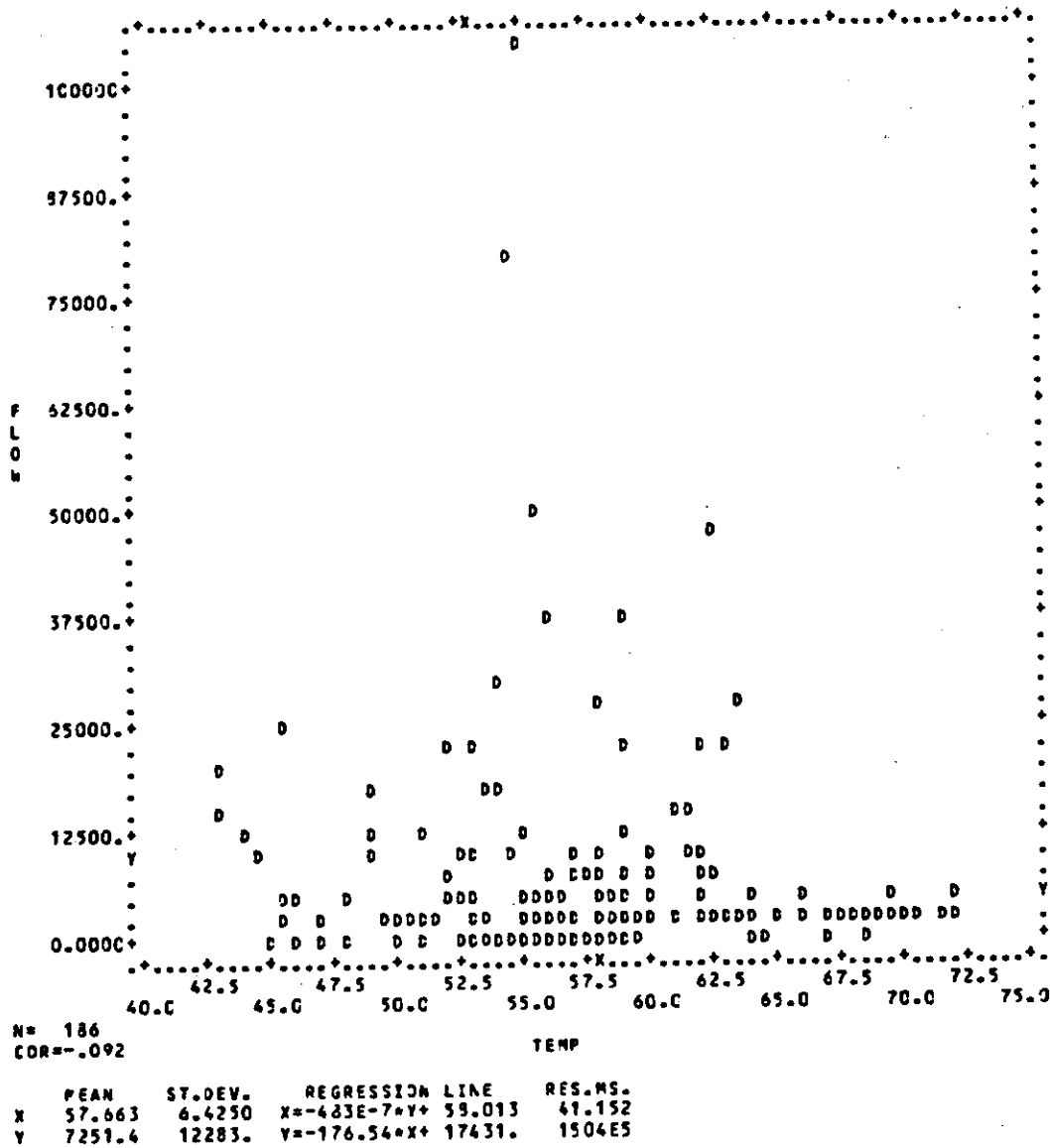


Figure A.9-12. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in October (1971-1977).

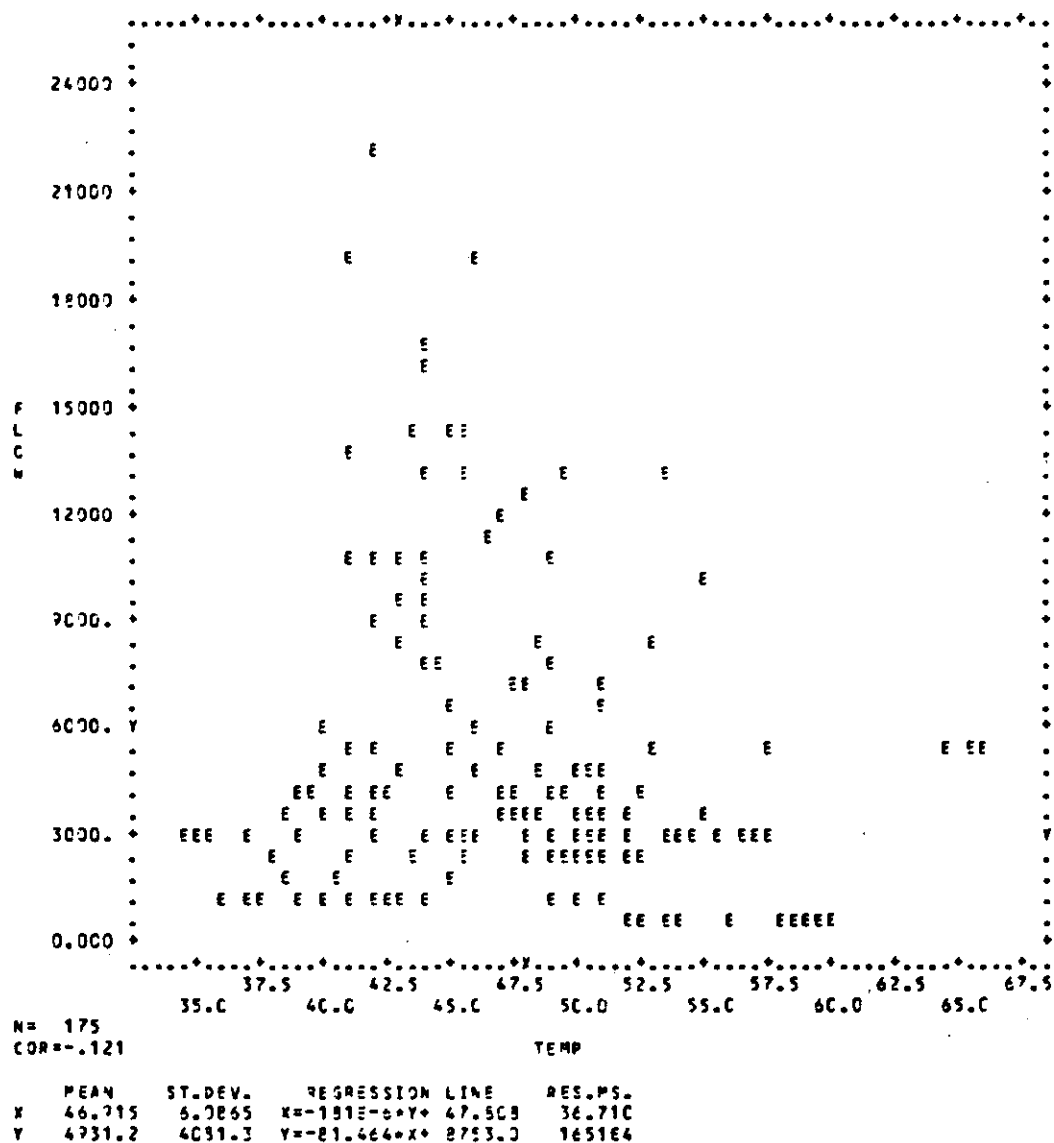


Figure A.9-13. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in November (1971-1977).

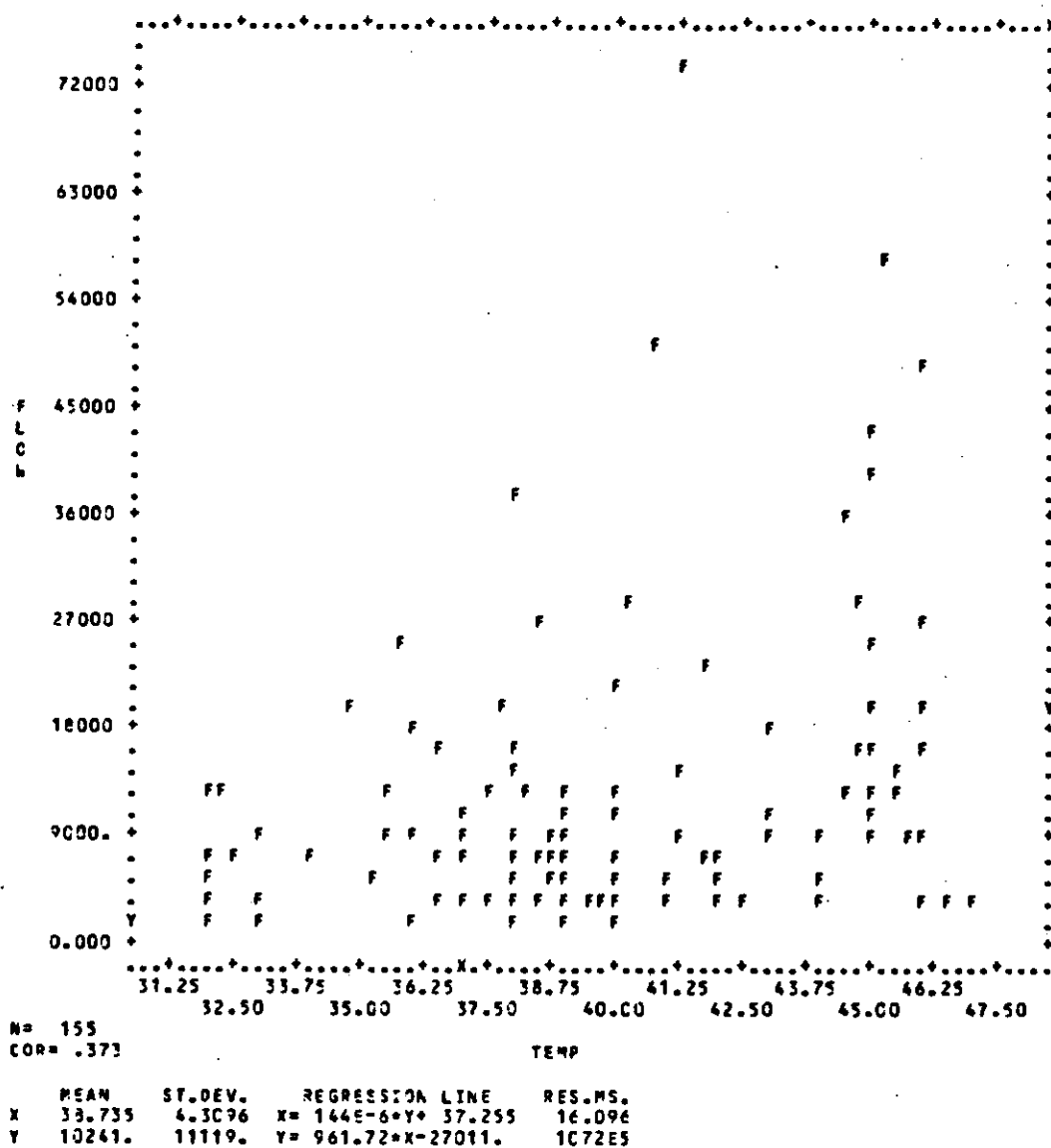


Figure A.9-14. Simple linear regression and scatter plot of stream flow (cfs) and water temperature (F) in December (1971-1977).

B APPENDICES

PERIPHYTON



APPENDIX B.1. THEORETICAL IMPACT OF PLANT THERMAL
DISCHARGE ON THE PERIPHYTON COMMUNITY
(EIA)

B.1-1. Objective

To determine the probability of adverse impact due to thermal discharge from the R.P. Smith power plant on the periphyton community in the Potomac River.

B.1-2. Data Source

Ref. 1.

B.1-3. Study History

Theoretical effects of discharge on periphyton were established based on output from the hydrothermal model (Appendix A.4) and a literature search.

B.1-4. Methods

- A literature search was conducted to determine the thermal tolerances of diatoms and green and blue-green algae. The critical temperatures which hypothetically change the dominant periphyton from diatoms to green algae, and green to blue-green algae are 86F and 95F, respectively. In the context of this study, blue-green algae were considered an undesirable component of the periphyton community.
- Adverse thermal conditions were defined as those in which temperatures capable of inducing shifts in the dominant periphyton from diatoms to green or blue-green algae had a $\geq 25\%$ probability of occurrence in $\geq 25\%$ of the available habitat.

B.1-5. Analysis

The probabilities of the occurrence of adverse thermal conditions were calculated using the hydrothermal model (Appendix A.4) and are presented for May, June, July, August, and September at both discharge and Transect 3 (1,000 feet downstream) locations.

B.1-6. Results

- During July and August there was at least a 90% chance of 7-day mean temperatures > 86F at the discharge site and at least a 20% chance of 7-day mean temperatures > 95F (Table B.1-1).
- There was only a small probability of adverse thermal conditions across the 25% cross section of Transect 3 (Table B.1-1).

B.1-7. Significance and Critique of Findings

- Any appreciable impact of plant thermal discharge on the periphyton community is most likely to occur within the discharge area.
- The validity of these results depends entirely on the accuracy of the hydrothermal model (Appendix A.4) and the relevance of the literature data on thermal tolerances of the algal groups (Ref. 1). Since the accuracy of the hydrothermal model is in question, the absolute value of some projected thermal increases above ambient may be off by a factor of 2.
- The reasons for using specific parameters to define adverse impact are not clearly justified. For example, it is questionable whether a 7-day exposure to the critical temperatures is necessary to result in a shift in the dominant periphyton. Also, basing potential effects on the periphyton community on exposure to the adverse temperature across 25% of the cross-sectional area, rather than at a single point in that cross section, may not be meaningful.
- The use of mean temperature over a 6.8-year period does not reflect annual variability. The predicted temperature distributions for July and August 1977 (Ref. 1, Appendix D) show a 100% and 50% probability of > 86F mean 7-day temperature at 25% of the cross section 1000 feet downstream in July and in August, respectively. The probability of 7-day mean water temperatures above 95F on the Maryland shoreline 1000 feet downstream is 50% in both July and August 1977. Since these values are greater than those computed for the 6.8-year period, the proposed analyses based on the long-term means may not be indicative of the plant effects on local periphyton populations.

- It is unclear whether the short-term changes suggested here have any long-term significance. No information is given concerning recovery times or even the ability to recover from thermal perturbations.

Table B.1-1. Percent probability of 7-day mean temperatures exceeding 86°F and 95°F during May-September at the discharge site and across a 25% cross section of Transect 3 (from Table 6-37 in Ref. 1).

Month	Discharge		Transect 3	
	>86°F	>95°F	>86°F	>95°F
May	>10	0	0	0
June	>40	>5	0	0
July	>90	>30	>10	0
August	>90	>20	>5	0
September	>60	>5	0	0

APPENDIX B.2. PERIPHYTON - NEARFIELD SURVEY
(EIA)

B.2-1. Objective

To determine the influence of the R.P. Smith power plant on the distribution and composition of the periphyton community in the Potomac River.

B.2-2. Data Source

Ref. 1.

B.2-3. Study History

Samples were taken in mid-August, 1977 and in mid-June, 1978.

B.2-4. Sampling Methods

Qualitative samples were taken by scraping the surfaces of available substrates (rocks, logs, mud) with a knife and preserving them in Lugol's solution. Sampling stations included 1/0.9, 2, 3/0.1, 3/0.9, 4/0.1, 4/0.9, 5/0.1, and 5/0.9, where 0.9 represents the Maryland shore, 0.1 represents the West Virginia shore, and the number before the / represents the transect (Figure B.2-1). Samples were scanned at 450x until 500 organisms were counted. All individuals except diatoms were identified and enumerated in this manner. Diatoms were examined by drying a representative aliquot of the sample, mounting it with Hyrax mounting medium, and identifying and counting 500 randomly encountered diatom frustules.

B.2-5. Analysis

- Relative abundances of the various periphyton species observed at the various stations were tabulated.
- Percent similarity of the diatom assemblages at the various stations was calculated using the equation

$$I = 100 \sum_i \min(a_i, b_i)$$

where a_i and b_i are the numerical proportions of species i in samples A and B.

- The matrix of percent similarity values was used to perform a cluster analysis (type of cluster analysis used was not documented).

B.2-6.

Results

- Diatoms were relatively more abundant than any of the other algal groups (Table B.2-1).
- During the August 1977 survey, the green algae reached their greatest relative population abundance (28.6%) in the thermal plume (Station 3/0.9) (Table B.2-1).
- Similar diatom assemblages were seen among the periphyton at the Conococheague Creek Station and at Stations 3/0.9 and 4/0.9 in June, 1978. However, during August, 1977, the diatom assemblage in the thermal plume (Station 3/0.9) showed little similarity to that in Conococheague Creek (Table B.2-2).
- There was little difference in the diatom assemblages at stations located on opposite sides of the river during August, 1977. In June, 1978, however, the cluster analysis revealed that the diatom assemblages along the West Virginia shore were unlike those observed along the Maryland shore and in Conococheague Creek (Figure B.2-2).

B.2-7.

Significance and Critique of Findings

- This study provides insufficient evidence for evaluating any influence due to plant thermal discharge on the periphyton community because:
 - No stations were sampled nearer than 1,000 feet to the discharge, and in the summer months the maximum downstream extent of the allowable mixing zone is < 1,000 feet.
 - Surveys were conducted only in summer months (June and August); hence proposed effects could not be extrapolated to other seasons of interest, particularly spring. Spring months generally are periods of maximal growth for periphytic species and increased local temperatures may affect this growth.

- It is necessary to assume that similar substrate types were equally represented and sampled at each station to allow for valid station-to-station comparisons (substrate type at stations was not documented). Other studies near the R.P. Smith plant showed differences in composition among periphyton communities on bedrock, pebble, and sand substrates.

Table B.2-1. Relative abundance (as % of total organisms observed) of the major periphyton groups.

Transect/Station	Diatoms	Greens	Blue-Greens	Other
August 1977				
1/0.9	98.2	1.0	<1	0
2	96.2	2.6	1.2	0
3/0.1	91.0	3.0	6.0	0
3/0.9	66.0	28.6	5.2	<1
4/0.1	86.4	2.2	11.4	0
4/0.9	98.2	1.4	<1	0
5/0.1	98.2	1.4	<1	0
5/0.9	100.0	0	0	0
June 1978				
1/0.9	98.8	1.2	0	0
2	96.0	2.0	2.0	0
3/0.1	98.6	1.2	<1	0
3/0.9	93.4	<1	6.4	0
4/0.1	76.2	5.0	18.8	0
4/0.9	90.6	9.0	<1	0
5/0.1	86.8	13.0	<1	0
5/0.9	90.2	7.6	2.2	0

From Tables 5-20, 5-21 in Ref. 1.

Table B.2-2. Matrix of similarity values* for the diatom assemblages observed at the various sampling stations. Values above the diagonal are for the August 1977 survey, below the diagonal for the June 1978 survey.

Transect/Station	1/0.9	2	3/0.1	3/0.9	4/0.1	4/0.9	5/0.1	5/0.9
1/0.9		14.6	50.8	34.4	51.6	36.0	54.6	25.8
2	32.2		10.6	14.0	17.2	46.8	14.8	47.2
3/0.1	27.0	16.2		34.2	38.4	35.8	50.8	24.4
3/0.9	31.0	66.0	15.6		26.6	40.6	42.8	36.8
4/0.1	25.2	13.6	67.4	17.4		35.2	42.8	28.4
4/0.9	30.8	47.8	19.2	44.8	14.8		42.6	65.4
5/0.1	27.4	18.8	79.4	20.6	64.0	22.6		31.6
5/0.9	51.8	37.9	18.6	38.6	15.6	37.6	24.4	

*Similarity value = $100 \sum \min(a_i, b_i)$; a_i, b_i = numerical proportions of species i in samples A and B, respectively. Data from Table 6-60 in Ref. 1.

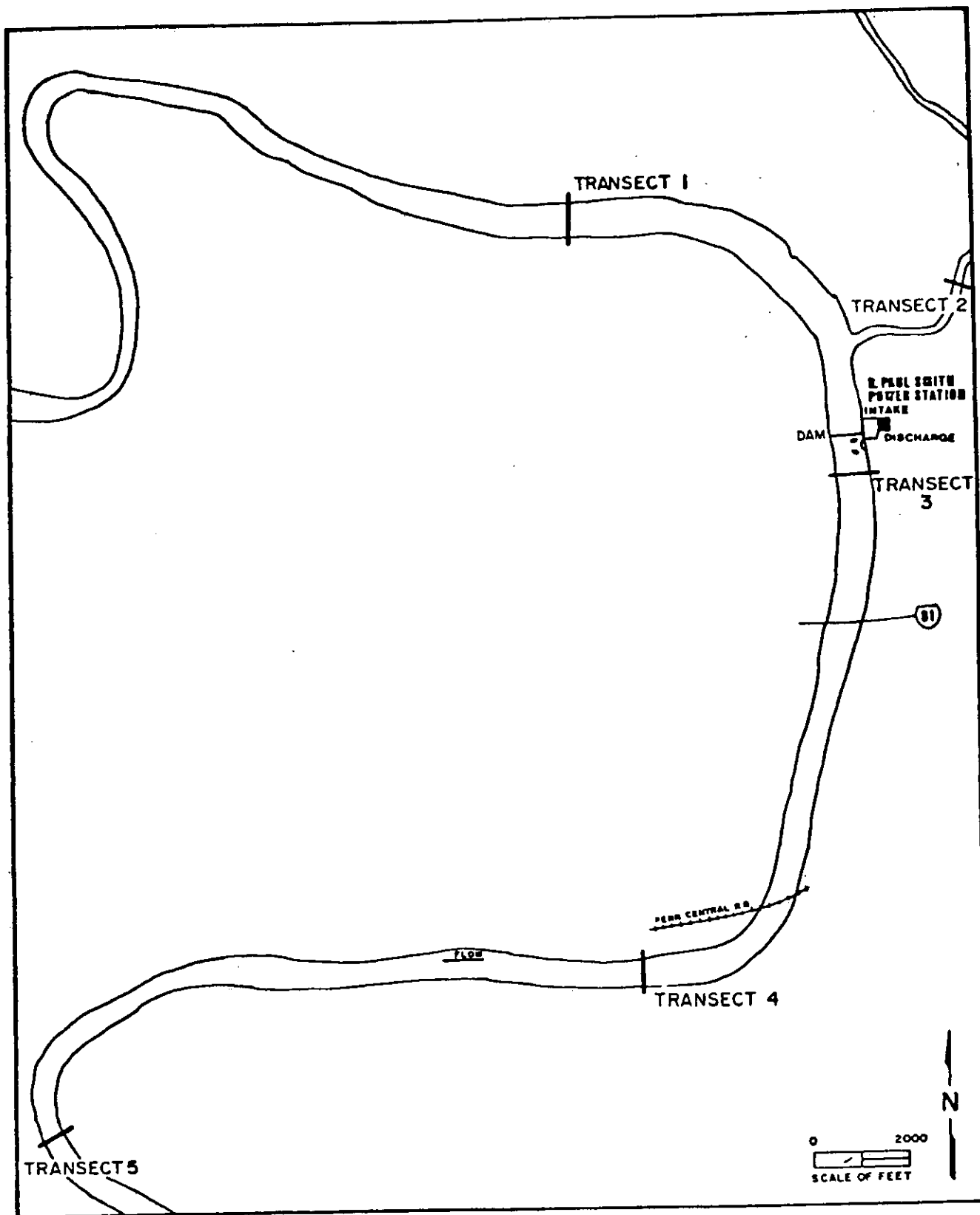


Figure B.2-1. Sampling stations utilized for the nearfield periphyton study. Along each transect, terms 0.1 and 0.9 refer to stations along the West Virginia and Maryland shores, respectively (from Ref. 1).

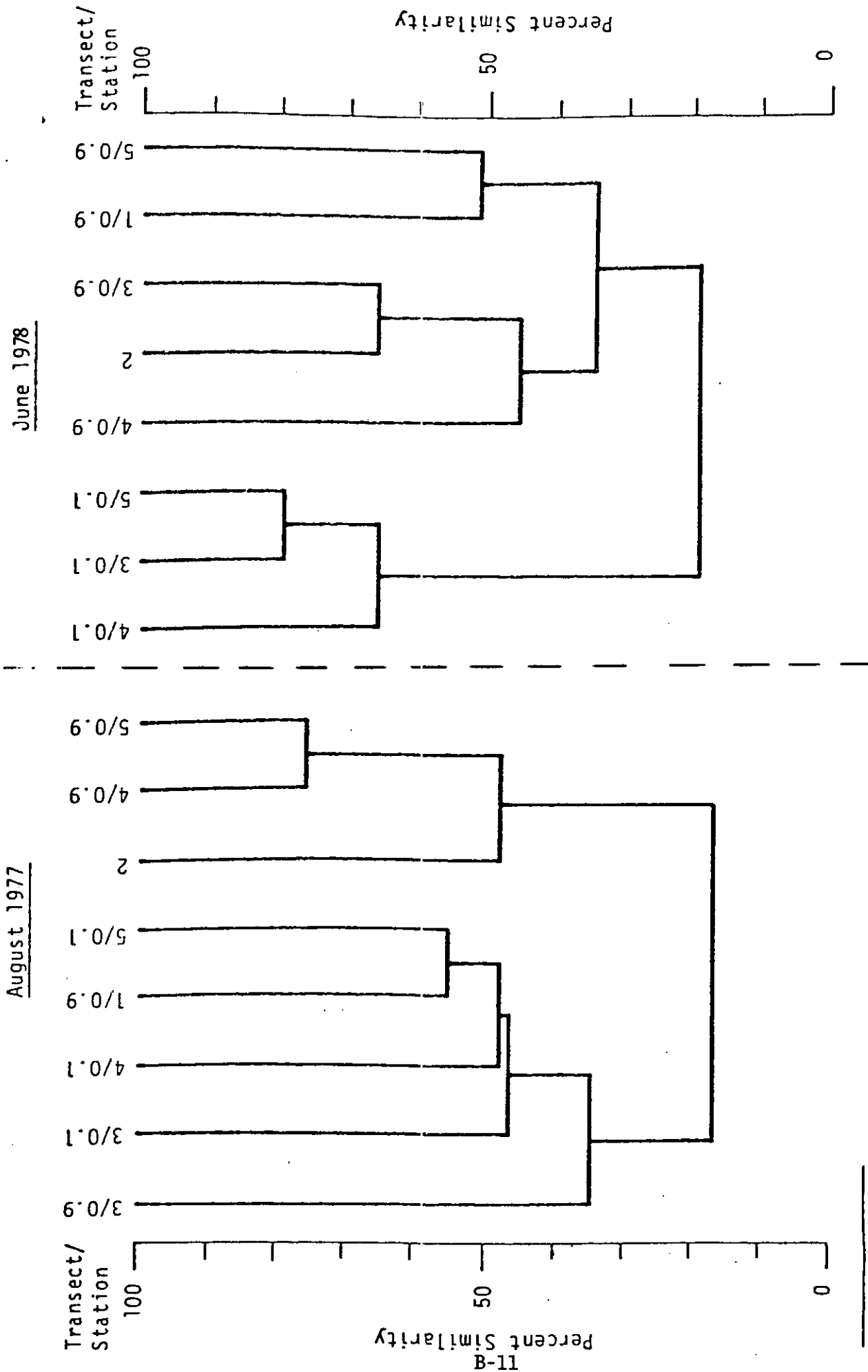


Figure B.2-2: Cluster analysis of similarity values of diatom assemblages from the various sampling stations in the Potomac River during August 1977 and June 1978 (from Ref. 1).

APPENDIX B.3. PERIPHYTON - ARTIFICIAL SUBSTRATES

(TI)

B.3-1. Objective

To determine the spatial distribution, composition, and abundance of periphyton within and outside the thermal plume generated by the R.P. Smith power station, and to evaluate the effects of the discharge water on local periphyton populations.

B.3-2. Data Source

Ref. 2.

B.3-3. Study History

Data were collected from July through November, 1979.

B.3-4. Sampling Methods

- Five sampling transects (Fig. B.3-1) were established in the study area; three within the plume generated by the R.P. Smith power station [outfall test (T3), intermediate plume test (T4) and far-field plume test (T5)] and two outside the plume [upstream (T2) and downstream (T6)]. Sampling stations were established on opposite sides of the river at each transect for comparative purposes. The Maryland side of the Potomac River was considered the right shore or bank; the West Virginia side, the left shore or bank.
- Paired, multiple-plate, Plexiglas® periphyton samplers were placed at each station (parallel to the current) over a 112-day period to evaluate successional status. Replicate pairs of plates were removed at 28-, 56-, 84-, and 112-day intervals.
- Additional samplers were placed at both stations along Transect 3 and replicate plates were collected weekly for a month to evaluate optimum exposure time for periphyton succession and document changes occurring during the first 28-day exposure period.
- During each sampling period the appropriate plates were removed and the periphyton from each sample were identified and enumerated.

- As a result of problems encountered in the field (e.g., loss of artificial substrates), comparisons were limited to right- and left-bank periphyton communities at Transect 2 (control above plant) and Transect 3 (plant discharge). Due to the shutdown of the R.P. Smith power plant during the summer of 1979, Transect 3 (right bank) was the only station to receive heated discharge.

B.3-5.

Analysis

- Weekly and monthly samples of periphyton from each artificial substrate station were identified and enumerated and total densities (no./cm²) were calculated for each major group and taxa. In addition, total biomass (total ash-free dry-weight, mg/cm²) and species diversity were computed.
- Of the species found on artificial substrates, five were selected for additional evaluation (Cocconeis placentula, Achnanthes minutissima, Melosira varians, Navicula rhynchocephala, and Diatoma vulgare). Selection was based on abundance or thermal range or because the species represented a major taxonomic group. Mean species densities were calculated, and comparisons (ANOVA and Duncan's Multiple Range Tests) were made among stations, transects, and months.
- CCNAOV (cross-classified nested analysis of variance) was performed to detect significant differences ($\alpha=0.05$) in monthly samples among transects, right and left banks, and transect-shore interactions for density and total biomass. The model used to analyze these variables is given in Table B.3-1.
- Kendall's coefficient of concordance was used to determine if there was a significant difference in the species composition between banks for monthly samples.

B.3-6.

Results

- Periphyton total densities in the successional study were similar at Transects 2 and 3 during all months except August when densities at Transect 3 were significantly higher ($\alpha=0.05$) (Table B.3-2). There were no significant differences in total density over the time period (July-November) that could be attributed to transect, bank, or plate effects (Table B.3-3). The only significant bank-to-bank difference was

observed in October when the total periphyton density at the unheated left bank was much higher than that at the heated right bank.

- Species diversity during the successional study was highest during August at Transect 2 (both banks) and lowest during October at Transect 3 (heated right bank). At the control transect (Transect 2), the diversity index at the left bank was consistently lower than at the right. No definite bank-to-bank trend was noted at thermally influenced Transect 3 (Table B.3-2).
- Statistical analysis of the successional data revealed significantly different total biomass levels ($\alpha=0.05$) (Table B.3-4) between Transects 2 and 3 depending on time (Table B.3-4). With Duncan's Multiple Range Test, significantly higher total biomass levels between the transects were seen in August and September, but no significant differences were found during October and November when thermal differences (effluent additions) between transects were greatest (Table B.3-5).
- Significant biomass differences in the successional data between right and left banks of Transects 2 and 3 were found only in September: the biomass at the unheated left bank at Transect 3 was significantly higher than at the right bank (Table B.3-6).
- Evaluation of the biomass taken from the October-November monthly colonization samples at Transects 2 and 3 revealed only slight bank-to-bank differences at Transect 2 but considerable differences at Transect 3. Total biomass for Transect 3 was also higher than at Transect 2 (Table B.3-7).
- For weekly incubations at Transect 3 (August), maximum total periphyton density was found at the right bank (thermally influenced) during the second week and at the left bank during the fourth week. Maximum diversity occurred during the first week at both banks (Table B.3-8).
- At the left bank of Transect 3, total periphyton density in weekly incubations increased gradually through the fourth week with greatest diversity occurring during the first week. At the right bank of Transect 3, highest diversity was also reached during the first week, but highest density was reached during the second week followed by a gradual decline through the fourth week (Table B.3-8).

- Monthly colonization (30-day incubations, analyzed only for November) showed highest density and diversity on the left bank at Transect 2, whereas at Transect 3, density was highest in the unheated left bank and diversity was highest on the heated right bank (Table B.3-9). Analysis of overall species composition between banks at Transect 3 with Kendall's coefficient of concordance showed that community composition was different between banks (Table B.3-10).
- Statistical analysis of monthly successional data on artificial substrates was not possible for Navicula rhynchocephala, Diatoma vulgare, and Melosira varians because of their infrequent occurrence (Table B.3-2).
- The mean densities (monthly succession on artificial substrates) of Cocconeis placentula for Transects 3 and 5 (only transects with comparable substrates; only limited data at Transect 5 available) were not significantly different ($\alpha = 0.05$) (Tables B.3-2 and B.3-11). There was no significant difference between right and left banks for the overall study.
- The mean densities (monthly successional data on artificial substrates) of Achnanthes minutissima were not consistent between Transects 2 and 3 or between shorelines (Table B.3-2). During September, mean densities were significantly higher at Transect 3. The only shore-to-shore difference was found during September at Transect 3 when the density at the left bank (unheated) was significantly higher (Tables B.3-12 and B.3-13).

B.3-7. Significance and Critique of Findings

- During the 1979 study, the R.P. Smith power plant was operating only at minimal capacity and therefore producing only a minor or nonexistent thermal plume ($< +2C$) from late July through September. Because the thermal effects were so slight and many artificial substrates were lost during the study period, a comprehensive evaluation of thermal effects is not possible.
- This study is of limited value for assessing the effects of the discharge plume on local periphyton populations for the following reasons:

- Total periphyton density and biomass are useful for assessing thermal effects only in a trophic analysis; these parameters do not address compositional or species-specific variations which may occur due to thermal additions.
- Physical differences between Transects 2 and 3 due to substrate type (Transect 2, sand; Transect 3, pebble) and flow characteristics (Transect 2, above dam; Transect 3, below dam) were not incorporated into the analyses.
- Lack of information for transects downstream of the plant discharge precludes determination of the downstream extent of potential effects.
- Since no effects on periphyton communities were seen in the discharge area in fall months, it is likely that regions downstream are also not affected.

Table B.3-1. Model used to analyze the data for total densities, chlorophyll a, and total biomass (from Ref. 2).

$$Y_{ijkl} = U + T_i + P_j + Pl_k + (TP)_{ij} + (TPl)_{ik} + (PPl)_{jk} + (TPPl)_{ijk} + E_{ijkl}$$

where

$i = 1, \dots, 5$ denoting the transects

$j = 1, 2$ denoting left or right bank

$k = 1, \dots, 7$ denoting the plate

$l = 1, 2$ denoting the sampler

Y_{ijkl} represents $\log_e (CPUE + 1)$ of the l^{th} plate in the k^{th} sec on the j^{th} bank of the i^{th} transect.

U is a parameter representing overall average $\log_e (CPUE + 1)$

T_i represents the effect of the i^{th} transect

P_j represents the effect of the j^{th} position in the river

Pl_k represents the effect of the k^{th} plate (e.g., summer or fall)

$(TP)_{ij}$ represents the joint effect of the i^{th} transect and the j^{th} position above and beyond the effect of each separately

$(TPl)_{ik}$ represents the joint effect of the i^{th} transect and the k^{th} plate above and beyond the effect of each separately

$(PPl)_{jk}$ represents the joint effect of the j^{th} position and the k^{th} plate above and beyond the effect of each separately

$(TPPl)_{ijk}$ represents the joint effect of the i^{th} transect and the j^{th} position and the k^{th} plate above and beyond the effect of each separately

E_{ijkl} represents the random error associated with the l^{th} replicate sampler for the k^{th} plate at transect i and position j . This error term is taken to be normally and independently distributed with a mean of zero and a variance of σ^2 .

Line	Source	Degrees of Freedom	Expected Mean Square
	Mean (U)	1	
1	Transect (T)	1	$\sigma^2 + 16\phi_T$
2	Position (P)	1	$\sigma^2 + 16\phi_P$
3	Plate (Pl)	3	$\sigma^2 + 8\phi_{Pl}$
4	T x P	1	$\sigma^2 + 8\phi_{TP}$
5	T x Pl	3	$\sigma^2 + 4\phi_{TPl}$
6	P x Pl	3	$\sigma^2 + 4\phi_{PPl}$
7	T x P x Pl	3	$\sigma^2 + 2\phi_{TPPl}$
8	Residual	16	σ^2
	Total	32	

ϕ denotes fixed effects.

σ^2 denotes variance component associated with factor.

Table B.3-2. Periphyton species density (no./cm²) collected from artificial substrates in the Potomac River near the R.P. Smith power station (from Ref. 2).

Taxa	Shore	August			September			October			November		
		Transect			Transect			Transect			Transect		
		2	3		2	3		2	3		2	3	
<u>Cocconeis placentula</u>	1	5780	63742		22719	71787		10375	17318		17396	39732	
	3	10124	31802		27975	17053		19320	8442		23002	8990	
<u>Achnanthes minutissima</u>	1	1626	3519		0	4038		740	1611		355	1790	
	3	5752	150		0	0		1449	53		615	51	
<u>Diatoma vulgare</u>	1	0	0		0	0		0	0		0	384	
	3	425	416		158	0		0	21		170	51	
<u>Navicula rhynchocephala</u>	1	15	879		0	3716		0	0		0	192	
	3	215	2358		624	0		0	0		0	51	
<u>Melosira varians</u>	1	0	0		0	1087		0	0		375	2812	
	3	227	31275		1097	0		0	0		205	0	
Total Density	1	10367	82108		28863	120080		13006	24340		20450	50321	
	3	29381	80385		47378	18240		35549	9072		28205	15929	
No. Taxa	1	43	35		17	33		24	29		23	21	
	3	50	36		34	16		25	14		27	27	
Diversity	1	3.42	1.65		1.31	2.41		1.40	1.90		1.11	1.09	
	3	3.53	2.21		2.38	0.71		1.96	0.51		1.37	2.48	
Evenness	1	0.70	0.37		0.38	0.53		0.35	0.44		0.29	0.28	
	3	0.70	0.49		0.52	0.21		0.48	0.17		0.33	0.59	
Temperature	1	22.2	24.0		20.0	20.0		11.0	12.0		8.6	8.0	
	3	22.3	23.3		21.5	21.0		11.0	15.2		8.6	11.8	
Duration (days)	183	28	28		56	56		84	84		112	112	

Table B.3-3. CCNAOV results for periphyton total density comparisons of Transects 2 and 3 (see Table B.3-1 for definition of variables) (from Ref. 2).

GENERAL LINEAR MODELS PROCEDURE									
DEPENDENT VARIABLE: TOT									
SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.		
MODEL	15	21.15149802	1.41009987	2.65	0.0309	0.713136	7.1720		
ERROR	16	8.50832177	0.53177011		STD DEV		TOT MEAN		
CORRECTED TOTAL	31	29.65981979			0.72922569		10.16762642		
SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F	
X	1	1.59453313	3.00	0.1026	1	1.59453313	3.00	0.1026	
Y	1	0.05525624	0.10	0.7514	1	0.05525624	0.10	0.7514	
PL	3	2.44939889	1.54	0.2438	3	2.44939889	1.54	0.2438	
XY	1	7.45632072	14.02	0.0018	1	7.45632072	14.02	0.0018	
XYPL	3	5.91723615	3.71	0.0337	3	5.91723615	3.71	0.0337	
YXPL	3	3.18196842	1.98	0.1573	3	3.18196842	1.98	0.1573	
XYXPL	3	8.51679247	0.32	0.8086	3	8.51679247	0.32	0.8086	

Table B.3-4. CCNAOV results for periphyton total biomass comparisons of Transects 2 and 3 (see Table B.3-1 for definition of variables) (from Ref. 2).

GENERAL LINEAR MODELS PROCEDURE									
DEPENDENT VARIABLES: CHEM_VAL									
SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.		
MODEL	15	0.30523250	0.02034883	5.35	0.0009	0.833879	43.6839		
ERROR	16	0.06080700	0.00380044		STD DEV		CHEM_VAL MEAN		
CORRECTED TOTAL	31	0.36603950			0.06164769		0.14112500		
SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F	
X	1	0.05362812	14.11	0.0017	1	0.05362812	14.11	0.0017	
Y	1	0.00577813	1.52	0.2354	1	0.00577813	1.52	0.2354	
PL	3	0.06339625	5.56	0.0083	3	0.06339625	5.56	0.0083	
X*Y	1	0.03976200	10.46	0.0052	1	0.03976200	10.46	0.0052	
X*PL	3	0.05880912	5.16	0.0110	3	0.05880912	5.16	0.0110	
Y*PL	3	0.05643562	4.95	0.0128	3	0.05643562	4.95	0.0128	
X*Y*PL	3	0.02742325	2.41	0.1054	3	0.02742325	2.41	0.1054	

Table B.3-5. Comparison of total periphyton biomass by transect (X) and recovery time (PL: 1 = August, 2 = September, 3 = October, 4 = November) (from Ref. 2).

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE CHEMVAL

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

ALPHA LEVEL=.05 DF=16 MS=0.0039

GROUPING		MEAN	N	X	PL
	A	0.298750	4	3	2
	A				
B	A	0.208750	4	3	1
B					
B	C	0.159750	4	3	4
B	C				
B	C	0.116250	4	2	2
	C				
	C	0.103000	4	2	4
	C				
	C	0.103500	4	2	3
	C				
	C	0.073000	4	2	1
	C				
	C	0.061000	4	3	3

Table B.3-6. Comparisons of total periphyton biomass by transect (X); bank (Y: 1 = West Virginia, 3 = Maryland); and recovery time (PL: 1 = August, 2 = September, 3 = October, 4 = November) (from Ref. 2).

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE CHEP_VAL

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

ALPHA LEVEL=.05 DF=16 MS=0.0038

GROUPING	MEAN	N	X	Y	PL
A	0.466000	2	3	1	2
B	0.216500	2	3	3	1
B	0.201000	2	3	1	1
B	0.183500	2	3	1	4
C	0.136000	2	3	3	4
C	0.136000	2	2	3	3
C	0.131500	2	3	3	2
C	0.123500	2	2	3	1
C	0.120000	2	2	3	2
C	0.112500	2	2	1	2
C	0.108500	2	2	3	4
C	0.107500	2	2	1	4
C	0.072500	2	3	1	3
C	0.071000	2	2	1	3
C	0.049500	2	3	3	3
D	0.022500	2	2	1	1

Table B.3-7. Dry-weight biomass (mg/cm^2) of periphyton collected from artificial substrates at the R.P. Smith site during monthly colonization sampling, October-November 1979 (from Ref. 2).

S.NO	R	SITE	X	Y	Z	BIOMASS
201	1	1	2	1	3	0.033
201	2	1	2	1	3	0.053
202	1	1	2	3	3	0.045
202	2	1	2	3	3	0.073
203	1	2	3	1	3	0.227
203	2	2	3	1	3	0.029
204	1	2	3	3	3	0.023
204	2	2	3	3	3	0.024
205	1	3	4	1	3	0.049
207	1	2	5	1	3	0.050
207	2	2	5	1	3	0.137
208	1	2	5	3	3	0.030
210	1	3	6	3	3	0.047
210	2	3	6	3	3	0.042

Table B.3-8. Density (no./cm²) of selected periphyton species from weekly succession on artificial substrates collected during August from the Potomac River near the R.P. Smith power station (from Ref. 2).

Taxa	Shore	Week 1		Week 2		Week 3		Week 4	
		3	R.A.*	3	R.A.	3	R.A.	3	R.A.
		Transect							
<u>Cocconeis placentula</u>	1 3	334 2075	22 14	19901 34177	93 39	23637 12896	66 24	48351 36390	89 82
<u>Achnanthes minutissima</u>	1 3	147 589	10 4	627 0	3 -	2189 214	6 <1	891 0	2 -
<u>Diatona vulgare</u>	1 3	8 68	1 <1	0 0	- -	135 277	<1 1	0 82	- <1
<u>Navicula rhyncocephala</u>	1 3	235 813	16 5	0 1494	- 2	822 362	2 1	0 556	- 1
<u>Melosira varians</u>	1 3	0 0	- -	0 5388	- 6	1202 31562	3 59	0 2390	- 4
Total Density	1 3	1487 15030		21371 88016		35575 53149		54077 44203	
No. Taxa	1 3	36 33		9 36		43 36		17 20	
Diversity	1 3	3.57 3.68		0.24 3.18		2.24 1.86		0.83 1.19	
Evenness	1 3	0.77 0.79		0.08 0.69		0.47 0.40		0.28 0.31	
Temperature	1 3								
Duration	1 3								

* Relative Abundance

Table B.3-9. Density (no./cm²) of selected periphyton species from monthly colonization on artificial substrates collected during November from the Potomac River near the R.P. Smith power station (from Ref. 2).

Taxa	Shore	October-November			Relative Abundance (%)
		Transect 2	Relative Abundance (%)	Transect 3	
<u>Cocconeis placentula</u>	1 3	138 712	5 46	334 137	15 10
<u>Achnanthes minutissima</u>	1 3	172 59	6 4	80 13	4 1
<u>Diatoma vulgare</u>	1 3	116 0	4 —	31 13	1 1
<u>Navicula rhynchocephala</u>	1 3	0 0	— —	3 7	<1 <1
<u>Melosira varians</u>	1 3	541 69	20 4	189 44	8 3
Total Density	1 3	2731 1541		2233 1391	
No. Taxa	1 3	41 35		35 41	
Diversity	1 3	4.16 3.27		3.99 4.24	
Evenness	1 3	0.83 0.70		0.85 0.86	
Temperature	1 3	8.6 8.7		8.0 11.8	
Duration	1&3	28		28	

Table B.3-10. Community comparisons of left and right banks at Transect 3 for artificial substrates using Kendall's coefficient of concordance W (from Ref. 2).

OBS	TAXA	LEFT	RIGHT	L_RANK	R_RANK
1	STIGEODONIUM (LPIL)	0	438.9	6.0	42.5
2	MELOSIRA VARIANS	5624	0.0	49.0	11.0
3	MELOSIRA ITALICA	767	0.0	40.5	11.0
4	CYCLOTELLA MENEHGINIANA	181	0.0	14.5	11.0
5	CYCLOTELLA (LPIL)	422	0.0	33.0	11.0
6	DIATOMA VULGARE	767	143.8	40.5	32.0
7	FRAGILARIA VAUCHERIAE	524	125.8	37.5	29.5
8	SYNEDRA ULNA	262	0.0	22.0	11.0
9	EUNOTIA (LPIL)	199	0.0	16.0	11.0
10	ACHNANTHES LANCEOLATA	79	125.8	12.5	29.5
11	ACHNANTHES LINEARIS	4606	106.8	48.0	27.0
12	ACHNANTHES MINUTISSIMA	6800	208.1	50.0	38.5
13	ACHNANTHES LEWISIANA	383	0.0	29.5	11.0
14	ACHNANTHES (LPIL)	1436	314.9	47.0	40.0
15	COCCONEIS PLACENTULA	114100	34864.0	51.0	51.0
16	COCCONEIS PEDICULUS	262	168.8	22.0	34.0
17	ANOMOEONEIS VITREA	262	0.0	22.0	11.0
18	CALONEIS (LPIL)	262	0.0	22.0	11.0
19	GYROSIGMA (LPIL)	0	125.8	6.0	29.5
20	NAVICULA CRYPTOCEPHALA	1389	2368.3	44.0	50.0
21	NAVICULA SALINARUM	1071	1261.8	43.0	45.0
22	NAVICULA RHYNCOCEPHALA	383	101.3	29.5	25.5
23	NAVICULA MINIMA	462	0.0	35.5	11.0
24	NAVICULA BACILLUM	383	0.0	29.5	11.0
25	NAVICULA SEMINULUM	0	438.9	6.0	42.5
26	NAVICULA VIRIDULA	0	2232.9	6.0	49.0
27	NAVICULA TRIPUNCTATA	383	1398.8	29.5	46.0
28	NAVICULA SUBMINUSCULA	0	42.7	6.0	23.0
29	NAVICULA NITROPHILA	262	42.5	22.0	22.0
30	NAVICULA (LPIL)	0	665.3	6.0	44.0
31	GOMPHONEMA SUBCLAVATUM	0	101.3	6.0	25.5
32	GOMPHONEMA OLIVACEOIDES	262	0.0	22.0	11.0
33	GOMPHONEMA (LPIL)	0	194.1	6.0	35.0
34	AMPHIORA PERPUSILLA	0	1469.9	6.0	47.0
35	CYMBELLA MICROCEPHALA	262	0.0	22.0	11.0
36	CYMBELLA AFFINIS	1412	208.1	45.5	38.5
37	CYMBELLA MINUTA	262	0.0	22.0	11.0
38	CYMBELLA SINUATA	462	168.3	35.5	33.0
39	CYMBELLA (LPIL)	524	0.0	37.5	11.0
40	NITZSCHIA ACICULARIS	383	0.0	29.5	11.0
41	NITZSCHIA PALEA	443	0.0	34.0	11.0
42	NITZSCHIA DISSIPATA	1412	1769.5	45.5	48.0
43	NITZSCHIA FRUSTULUM	256	50.3	17.0	24.0
44	NITZSCHIA TRYBLIONELLA	262	0.0	22.0	11.0
45	NITZSCHIA ANGUSTATA	181	0.0	14.5	11.0
46	NITZSCHIA DEHTICULA	383	0.0	29.5	11.0
47	NITZSCHIA SPHAEROPHORA	0	202.6	6.0	36.5
48	NITZSCHIA (LPIL)	0	125.8	6.0	29.5
49	CYMATOPLEURA SOLEA	79	0.0	12.5	11.0
50	SURIRELLA OVATA	645	202.6	39.0	36.5
51	BACILLARIOPHYTA-PENNATE (LPIL)	826	333.2	42.0	41.0

OBS	GROUP	W	F	DF1	DF2	PROB
1	1	0.533468	1.14348	49	49	0.320358

Table B.3-11. Comparison of Cocconeis placentula densities at Transects 3 and 5 (from Ref. 2).

GENERAL LINEAR MODELS PROCEDURE									
DEPENDENT VARIABLE: LOGDENS		DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.	
SOURCE	MODEL	5	10.35661009	2.07132202	2.24	0.1771	0.651326	10.6156	
SOURCE	ERROR	6	5.54420617	0.92403436		STD DEV			
SOURCE	CORRECTED TOTAL	11	15.90081626			0.96126706		LOGDENS MEAN	
SOURCE	MONTH	1						9.05521114	
SOURCE	STATION	2							
SOURCE	MONTH*STATION	2							
TESTS OF HYPOTHESES USING THE TYPE IV MS FOR MONTH*STATION AS AN ERROR TERM									
SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F	
STATION	2	0.02205564	0.02	0.8823	1	0.02205564	0.02	0.8823	
		0.86586082	4.80	0.0570	2	0.86586082	4.80	0.0570	
		1.46669364	0.79	0.4941	2	1.46669364	0.79	0.4941	

*Analysis including only the stations with similar substrates Transect 3 and right bank Transect 5 and the months with highest thermal influence.

Table B.3-12. Comparison of *Achnanthes minutissima* densities at Transects 1 and 2 (from Ref. 2).

GENERAL LINEAR MODELS PROCEDURE										
DEPENDENT VARIABLE: LOGDENS										
SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.			
MODEL	15	281.70303250	18.78053550	3.72	0.0066	0.776937	47.5129			
ERROR	16	80.87920343	5.05495021							
CORRECTED TOTAL	31	362.58223594								
								LOGDENS MEAN		
									2.24632164	4.73202798
SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F		
X	1	5.26618668	1.04	0.3225	1	5.26618668	1.04	0.3225		
Y	1	33.66603987	6.66	0.0201	1	33.66603987	6.66	0.0201		
PL	3	96.54707428	6.37	0.0048	3	96.54707428	6.37	0.0048		
X*Y	1	64.87105767	12.83	0.0025	1	64.87105767	12.83	0.0025		
X*PL	3	60.35513126	3.98	0.0270	3	60.35513126	3.98	0.0270		
Y*PL	3	11.10637433	0.73	0.5477	3	11.10637433	0.73	0.5477		
X*Y*PL	3	9.89416642	0.65	0.5929	3	9.89416642	0.65	0.5929		

STATISTICAL ANALYSIS SYSTEM

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE LOGDENS

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

ALPHA LEVEL=.05 DF=16 MS=5.05495

GROUPING	MEAN	N	X	Y	PL
A	8.633963	2	2	3	1
A	8.032641	2	3	1	1
A	7.841751	2	3	1	2
A	7.279208	2	2	3	3
A	7.137201	2	3	1	3
A	6.544686	2	2	1	3
A	6.541933	2	2	1	1
A	6.230344	2	2	3	4
A	5.872069	2	2	1	4
A	4.091556	2	3	1	4
A	2.852972	2	3	3	1
A	2.340208	2	3	3	3
A	2.313916	2	3	3	4
B	0.000000	2	2	3	2
B	0.000000	2	3	3	2
B	0.000000	2	2	1	2

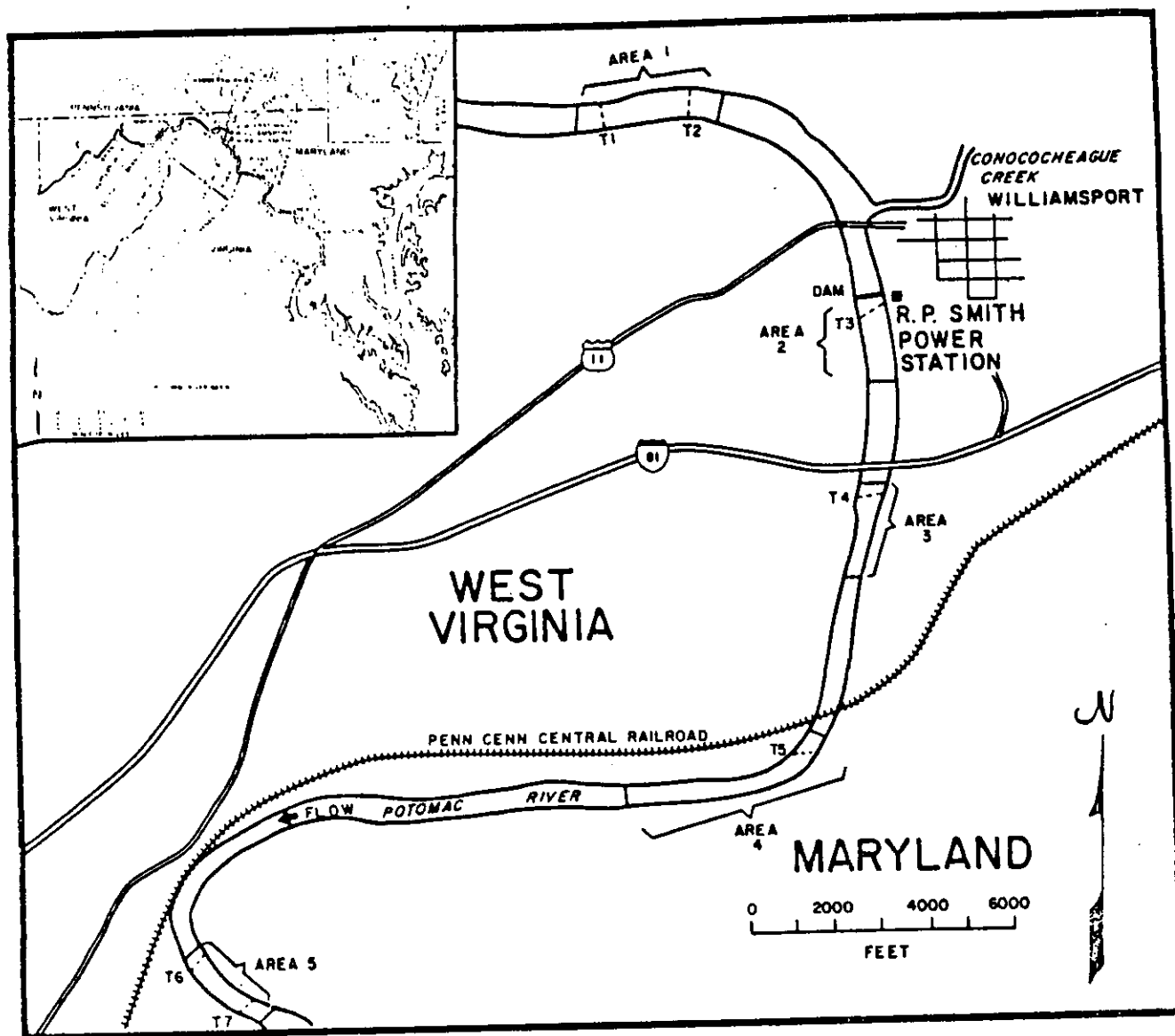


Figure B.3-1. Locations of sampling areas/transects for biological sampling in the vicinity of R.P. Smith power station (from Ref. 2).

APPENDIX B.4. PERIPHYTON - COMPARISON OF ARTIFICIAL AND
NATURAL SUBSTRATES

(TI)

B.4-1. Objective

To determine whether qualitative differences exist between periphyton community composition on colonized artificial samplers and natural substrates within and outside the thermal plume generated by the R.P. Smith power station.

B.4-2. Data Source

Ref. 2.

B.4-3. Study History

Data were collected from July through November 1979.

B.4-4. Sampling Methods

- Five sampling transects (Fig. B.4-1) were established in the study area; three within the plume generated by the R.P. Smith power station [outfall test (T3), intermediate plume test (T4) and farfield plume test (T5)] and two outside the plume [upstream (T2) and downstream (T6)]. Sampling stations were established on opposite sides of the river at each transect for comparative purposes. The Maryland side of the Potomac River was considered the right shore or bank; the West Virginia side, the left shore or bank.
- Paired, multiple-plate, Plexiglas® periphyton samplers were placed at each station (parallel to the current) over a 112-day period. Replicate pairs of plates were removed at 28-, 56-, 84-, and 112-day intervals.
- During each sampling period the appropriate plates were removed and the periphyton were identified and enumerated.
- Scrapings from one rock and one wood substrate at each location (when available) were taken and preserved for general taxa comparison with the artificial substrate samplers.

- As a result of problems encountered in the field (i.e., loss of artificial substrates), comparisons were limited to right- and left-bank periphyton communities at Transect 2 (control above plant) and Transect 3 (at the plant discharge). Due to the shutdown of the R.P. Smith power plant during the summer of 1979, Transects 3 and 4 (right bank) were the only stations to receive heated discharge and then only during October and November.

B.4-5. Analysis

- The periphyton community for each artificial substrate station was evaluated in terms of species composition and dominance (Appendix B.3).
- No density estimates were calculated and no statistical analyses performed on samples of natural substrate periphyton. Existing natural substrate periphyton were examined for general taxa comparison with the artificial substrate samplers.

B.4-6. Results

- During July, August, September, and November more taxa (periphyton), specifically, more diatom taxa, were found on the natural substrate than on the artificial substrate.
- October samples showed similar taxonomic components between natural and artificial substrates (believed to result from the scouring effect of heavy rains on the natural substrate).
- Taxa on natural substrates throughout the sampling period (July-November) generally were similar on both shores during any single sampling month. This similarity also occurred at Transect 3 although some differences were observed between shores.
- The only month in which major group taxonomic differences were noted between transects on natural substrates was July, when more blue-green algal taxa were collected at Transect 2, the control area. During other months, specific taxa differences existed between shores and transects but there were no major differences.

B.4-7.

Significance and Critique of Findings

- During the 1979 study, the R.P. Smith power plant was operating only at minimal capacity and therefore producing only a minor or nonexistent thermal plume ($< +2^{\circ}\text{C}$) from late July through September.
- The results of this comparison suggest that artificial substrate colonization may not accurately mimic community composition of natural substrate colonization. Furthermore, to ascertain the similarity of periphytic colonization on artificial and natural substrates more accurately, quantitative studies would be required.
- Due to the qualitative nature of these studies, definite conclusions cannot be made concerning the representativeness of results obtained using artificial substrate samplers.
- Analyses should be completed to determine if natural substrate differences in periphytic community composition occur between rock and wood substrates (Appendix B.6).

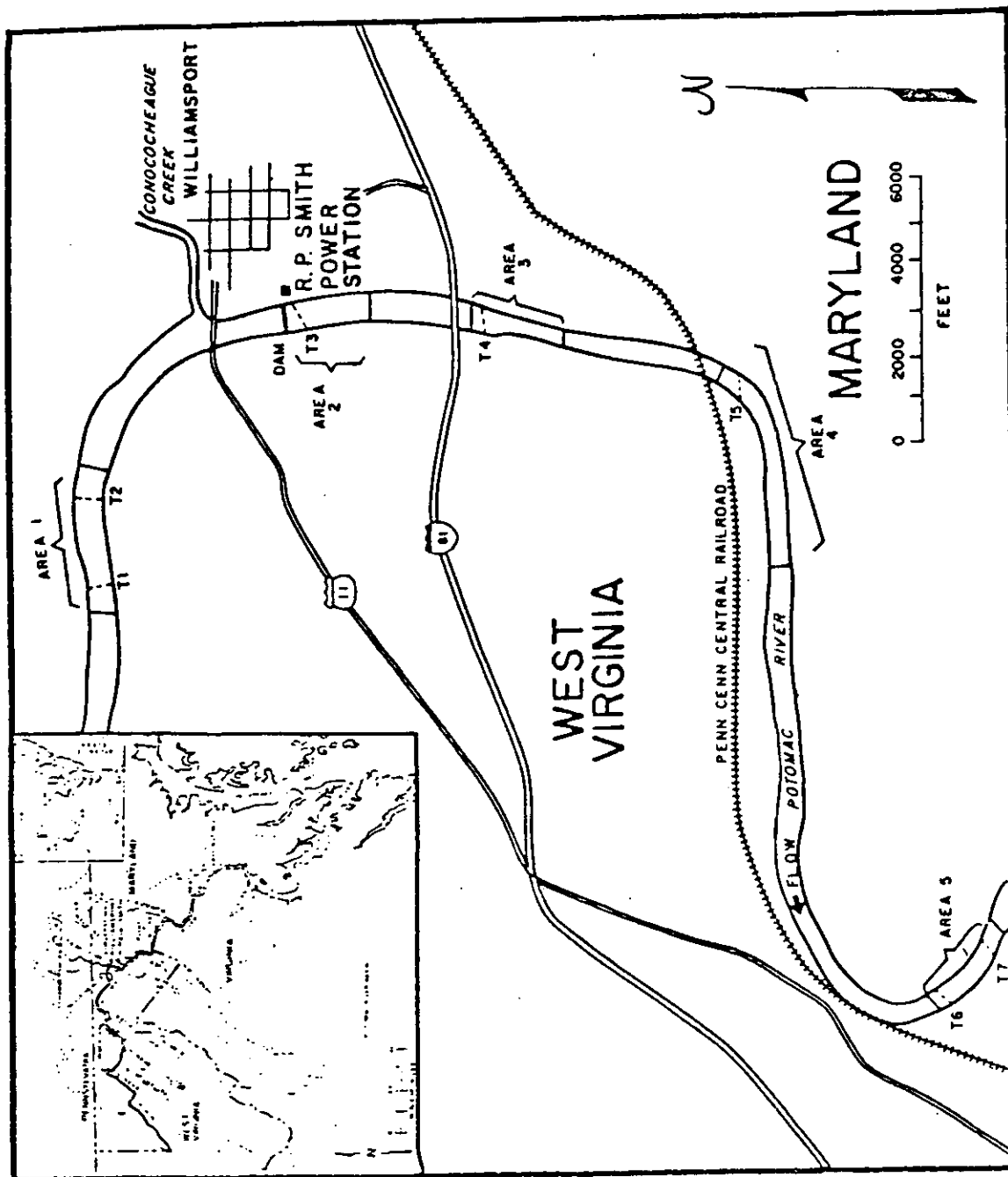


Figure B.4-1. Locations of sampling areas and transects for periphyton sampling (from Ref. 2).

APPENDIX B.5. PERIPHYTON - CHLOROPHYLL a AND
PHAEOPHYTIN CONCENTRATIONS

(TI)

B.5-1. Objective

- To assess the effects of the thermal effluent from the R.P. Smith power station on chlorophyll a concentrations in the surrounding Potomac River waters.

B.5-2. Data Source

Ref. 2.

B.5-3. Study History

Data were collected from July to November 1979 in conjunction with the artificial substrate colonization study (Appendix B.3).

B.5-4. Sampling Methods

- Five sampling transects (Fig. B.5-1) were established in the study area; three within the plume generated by the R.P. Smith power station [outfall test (T3), intermediate plume test (T4) and far-field plume test (T5)] and two outside the plume [upstream (T2) and downstream (T6)]. Sampling stations were established on opposite sides of the river at each transect for comparative purposes. The Maryland side of the Potomac River was considered the right shore or bank; the West Virginia side, as the left shore or bank.
- Paired, multiple-plate, Plexiglas® periphyton samplers were placed at each station (parallel to the current) over a 112-day period. Replicate pairs of plates were removed at 28-, 56-, 84-, and 112-day intervals.
- Chlorophyll a samples were collected from each station at 28-day intervals. To prepare samples for analysis, a constant area of the artificial substrate was scraped and filtered through a 0.45- μ filter stabilized with magnesium carbonate. Chlorophyll was extracted from each filter using 90% acetone. The filter paper was then ground for 30 seconds, centrifuged, and measured on a narrow-band spectrophotometer at 665- and 750-nm wavelengths before and after sample acidification.

Both chlorophyll a and phaeophytin a (a degradation product) concentrations were calculated ($\mu\text{g}/\text{cm}^2$).

B.5-5. Analysis

- Chlorophyll a and phaeophytin a concentrations were determined for each artificial substrate station.
- CCNAOV (cross-classified nested analysis of variance) was performed to detect significant differences ($\alpha = 0.05$) in monthly samples between transects, right and left banks, and transect-shore interactions for chlorophyll a concentrations.

B.5-6. Results

- Chlorophyll a and phaeophytin a concentrations by transect, bank, and recovery time are given in Table B.5-1.
- Statistical analysis of monthly changes in chlorophyll a concentrations revealed no significant differences (Table B.5-2) between transects, right and left shores, recovery time, or interactions between transect, shore, and recovery time (Table B.5-2).

B.5-7. Significance and Critique of Findings

- The study did not accomplish its primary objective because:
 - The R.P. Smith power plant was operating only at minimal capacity and therefore producing only a minor or nonexistent thermal plume in the discharge area (ΔT ranges from 0 - 8°C) from late July through September. The extent of the plume varied daily but the thermal differential in the discharge area was generally $\geq +2^\circ\text{C}$ above ambient.
 - During periods of maximum temperature differential (right to left bank; Transect 3; October and November), no differences were detected in chlorophyll a concentrations.
 - Physical differences between Transects 2 and 3 due to substrate type (Transect 2, sand; Transect 3, pebble) and flow characteristics (Transect 2, above dam; Transect 3, below dam) were not incorporated into the analyses.

- The high variability between replicate samples suggests a low capability for detecting differences between chlorophyll concentrations at different stations.
- The high incidence of negative chlorophyll a concentrations is not explained.

Table B.5-1. Concentrations of chlorophyll a and phaeophytin from periphyton collected from artificial substrates during monthly succession sampling at the R.P. Smith site (adapted from Ref. 2).

<u>August 1979</u>					<u>September 1979</u>				
X	Y	Z	CHL A*	PHAEOP*	X	Y	Z	CHL A*	PHAEOP*
2	1	3	2.00	2.25	2	1	3	1.04	14.57
2	1	3	4.89	0.95	2	1	3	3.92	16.43
2	3	3	-0.10	22.26	2	3	3	1.29	19.02
2	3	3	2.88	12.93	2	3	3	2.64	17.09
3	1	3	2.88	13.21	3	1	3	0.89	17.32
3	1	3	1.23	14.75	3	1	3	-0.10	23.57
3	3	3	-0.10	20.40	3	3	3	2.16	19.25
3	3	3	2.72	17.74	3	3	3	5.45	10.08

<u>October 1979</u>					<u>November 1979</u>				
X	Y	Z	CHL A*	PHAEOP*	X	Y	Z	CHL A*	PHAEOP*
2	1	3	3.04	15.90	2	1	3	-0.10	21.93
2	1	3	-0.10	27.83	2	1	3	3.84	13.71
2	3	3	2.72	18.19	2	3	3	3.23	13.42
2	3	3	0.88	22.28	2	3	3	-0.10	24.59
3	1	3	-0.10	19.37	3	1	3	-0.10	23.83
3	1	3	2.95	18.79	3	1	3	-0.10	25.44
3	3	3	1.32	22.37	3	3	3	5.29	6.10
3	3	3	9.69	1.35	3	3	3	-0.10	20.51

*Table value of Chl a or Phaeop = $\frac{\text{ug/cm}^2 \text{ Chl } \underline{a} \text{ or Phaeophytin}}{232.3}$

Table B.5-2. Comparisons of chlorophyll a concentrations by transect (X), bank (Y), recovery time (PL), and interaction terms (from Ref. 2).

GENERAL LINEAR MODELS PROCEDURE									
DEPENDENT VARIABLE: CHEM_VAL									
SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.		
MODEL	15	55.07440000	3.67162667	0.60	0.8335	0.360931	119.2633		
ERROR	16	97.51560000	6.09472500		STD DEV		CHEM_VAL MEAN		
CORRECTED TOTAL	31	152.59000000			2.46874969		2.07000000		
SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F	
X	1	0.15401250	0.03	0.8757	1	0.15401250	0.03	0.8757	
Y	1	6.10751250	1.00	0.3317	1	6.10751250	1.00	0.3317	
PL	3	4.81765000	0.26	0.8507	3	4.81765000	0.26	0.8507	
X*Y	1	18.12020000	2.97	0.1039	1	18.12020000	2.97	0.1039	
X*PL	3	8.47323750	0.46	0.7118	3	8.47323750	0.46	0.7118	
Y*PL	3	15.13693750	0.83	0.4977	3	15.13693750	0.83	0.4977	
X*Y*PL	3	2.26485000	0.12	0.9446	3	2.26485000	0.12	0.9446	

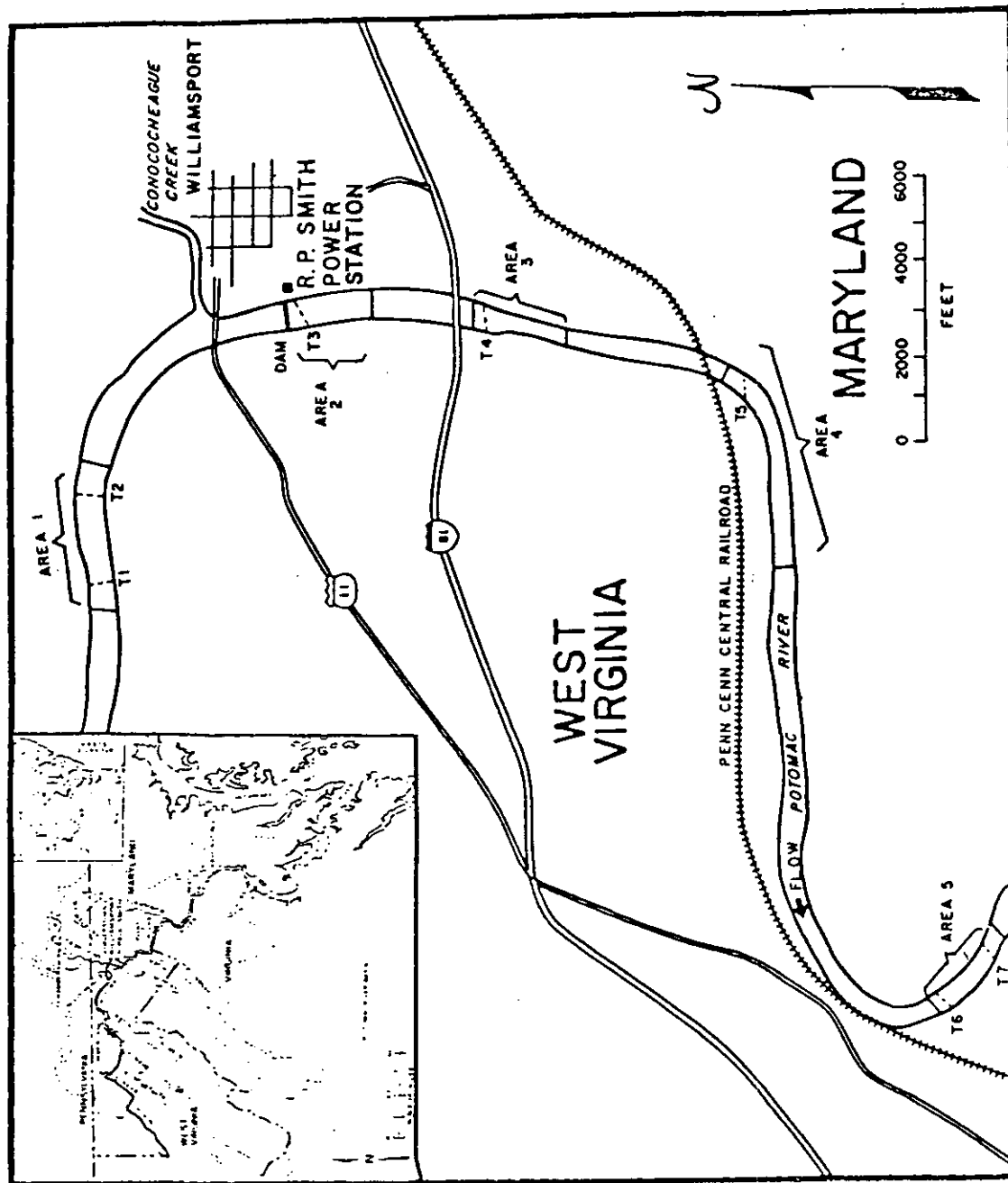


Figure B.5-1. Locations of sampling areas and transects for biological sampling (from Ref. 2).